CRYSTAL RIVER TRAIL
PRELIMINARY WILDLIFE ANALYSIS, PITKIN COUNTY, COLORADO

Prepared for:

Wilderness Workshop

P.O. Box 1442
Carbondale, CO 81623
www.wildernessworkshop.org

JULY, 2017

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

1.0 EXECUTIVE SUMMARY

Wilderness Workshop retained Western Ecosystems, Inc. to conduct an independent review of the more significant wildlife issues associated with potential effects of the Crystal River multi-use recreation trail in Pitkin County using the most current data and the best available science. Goals of the analysis were to (1) educate the public about the more significant wildlife-related issues and impacts arising from any new trail construction and (2) provide facts to Pitkin County and the U.S. Forest Service (USFS) for the National Environmental Policy Act (NEPA) process.

Wildlife concerns have been one of the most important resource issues associated with the proposed trail since its conception in the early 1990's. Findings of the more substantive and pertinent wildlife analyses and professional correspondence associated with the conceptual Crystal River trail were reviewed and summarized in the report. The wildlife record documenting the critical, high value, and diverse wildlife habitats in the valley was consistent and extensive. In particular, former analyses of wildlife and habitat use in the Crystal River valley highlighted the importance of the largely intact, isolated, unfragmented, and high value wildlife habitats on the east side of the Crystal River north of the town of Redstone.

Potential trail segments were based largely on those identified in the most recent and detailed trail feasibility study to date (Newland Project Resources 2004). That study identified potential trail segments located within the existing Highway 133 corridor, three trail segments following an historic railroad grade east of the Crystal River, existing Redstone Boulevard, the Hayes Creek Canyon bypass west of the highway, and the existing old McClure Pass Road switchbacks. That study indicated that with the exception of Hayes Creek Canyon, where a potential 1.5 mile bypass was identified, a bike trail could be located alongside, or offset from, Highway 133 through the entire length of Pitkin County's Crystal River Trail analysis area.

The evaluation of current wildlife use of the Crystal River valley was based largely on the large wildlife and ecological databases, particularly Colorado Parks and Wildlife (CPW) mapping. Federally-listed and proposed animal species, USFS Region 2 sensitive animal species, eight CPW-mapped wildlife species, habitat conditions, other wildlife groups, and other noteworthy resource issues were considered. Detailed CPW maps and descriptions of seasonal habitat use for the more sensitive wildlife species present are provided. Bighorn sheep and elk are the wildlife species of particular concern. Potential trail effects on wildlife and habitats are summarized, including the general effects of recreational use on wildlife and case studies documenting wildlife responses to different user groups pertinent to the particular species and potential trail issues in the Crystal River analysis area. The scientific literature review showed how <u>all</u> types of recreational activities can have negative effects on wildlife.

Potential trail siting considerations were based on (1) anticipated trail use effects on wildlife and their habitats, as documented in the scientific literature, (2) results of prior wildlife analyses in the Crystal River valley, and (3) the experience and recommendations of professional wildlife biologists and managers, particularly those from the state wildlife management agency.

Based on the analysis, the Crystal River trail would have the least negative effects on wildlife habitats and ecological communities if it was located within existing disturbance corridors (i.e., along Highway 133 and Redstone Boulevard) and along the Hayes Creek bypass (identified only because Newland Project Resources [2004] indicated that a viable trail was not possible through Hayes Creek canyon). A trail following this route would cross through some important wildlife habitats and result in direct and indirect habitat losses. However, with the exception of the Hayes Creek bypass, all of the affected habitat would

be within the highway's and Redstone Boulevard's existing zones of influence, where habitat effectiveness has been reduced for most species, including those species of greatest concern (sheep and elk). The above trail alignment would be far better for the wildlife community than introducing new trail use into currently buffered, isolated, highly effective, and large unfragmented blocks of critical and important wildlife habitat. This recommendation is consistent with ecological recommendations: (1) in the scientific literature, (2) from CPW, (3) in the 2007 Crystal River Caucus Wildlife and Habitat Report, and (4) in the 2008 Filoha Meadows Management Plan. Additional construction timing, seasonal trail use, and other measures and considerations that would avoid, minimize, and mitigate negative wildlife effects resulting from development and use of all potential Crystal River trail segments are presented.

A considerable amount of adjacent habitat can be affected by recreational trail use. Depending on the trail segments selected, the Crystal River trail could either have relatively minor effects (with a highway, Redstone Boulevard, and Hayes Creek bypass alignment, affecting to some extent approximately 111 ac.) on wildlife and ecological communities, or have the largest, single, negative effect to wildlife habitats in the valley since Highway 133 was upgraded in the late 1960's (with highway segments, three trail sections east of the river, the Hayes Creek bypass, and the old McClure Pass switchbacks, affecting to some extent approximately 875 ac.).

2.0 INTRODUCTION

A public recreation trail in the Crystal River Valley has been under consideration since 1991 when the Colorado Scenic and Historic Byway Commission established the West Elk Loop Scenic and Historic Byway (hereinafter the "byway"). One of the most significant resource concerns consistently associated with a public recreation trail in the Crystal River Valley was, and remains, wildlife. Several trail feasibility studies have been conducted (Pitkin County Open Space and Trails 1994, Edaw[1] 2000, Newland Project Resources 2004). An unusually large number of analyses focusing on wildlife issues have also been conducted. Pitkin County has acquired nine open space parcels to protect wildlife habitat and facilitate a recreation trail on the east side of the Crystal River. The Colorado Division of Wildlife (CDOW, name changed to Colorado Parks and Wildlife [CPW] in June, 2012), the state wildlife agency, has commented since 2002 on open space parcel acquisition and potential trail development effects on wildlife. In 2016, the 2003 Crystal River Valley Master Plan, a community-based Master Plan developed jointly by Pitkin County and the residents and Caucus of the Crystal River Valley, was updated to reflect current concerns and goals, including wildlife.

In late 2016, Great Outdoors Colorado (GOCO) awarded a grant to Pitkin County for planning the Carbondale to Crested Butte Trail. The trail will extend roughly 83 miles between Carbondale and Crested Butte. The trail project was named to Governor John Hickenlooper's Colorado the Beautiful Initiative earlier in 2016, placing it on a list of 16 priority trail projects across the state. Planning for the Carbondale to Crested Butte Trail will be a year-long effort, involving the public, Pitkin and Gunnison Counties, the Town of Crested Butte, the Colorado Department of Transportation, CPW, and both the White River (WRNF) and Grand Mesa/Uncompahgre/Gunnison National Forests. Within Pitkin County, the planning will focus on route options between the existing terminus of the Crystal Valley Trail, south of Carbondale, and the top of McClure Pass. The GOCO-planning grant will be combined with an allocation from Pitkin County Open Space and Trails (PCOST) to fund planning work, and environmental

[1] Edaw, Inc. is a private landscape counseling and planning firm located in Fort Collins, CO.

and engineering studies for the envisioned trail. Pitkin County Open Space and Trails began the Crystal River trail planning phase early in 2017.

In early 2017, with trail planning in Pitkin County moving forward, Wilderness Workshop retained Western Ecosystems, Inc. to conduct an independent review of the more significant wildlife issues associated with potential Crystal River Trail effects in Pitkin County using the most current data and the best available science. Goals of the analysis were to (1) educate the public about the more significant wildlife-related issues, (2) provide detailed information to help inform PCOST and the Pitkin County Board of County Commissioners, and (3) serve as a foundation for Wilderness Workshop's engagement in the National Environmental Policy Act (NEPA) process.

Both the author and Wilderness Workshop recognize that while land use and development decisions, including recreation, often result in impacts to wildlife, this does not necessarily mean that no use or development should occur. This analysis is not intended to justify opposition to a trail up the Crystal Valley or definitively determine a set of alignments. Rather, the goal is to ensure a thorough third party analysis of impacts to wildlife. Pitkin County and the USFS are also committed to wildlife analyses for the proposed trail and this report is intended to complement and add to those analysis as well as providing the accountability that only an independent evaluation can. Additionally, aspects of the trail project including engineering, costs, safety, user experience, management, legal issues, private property rights, and many other considerations will be part of both Pitkin County's and the Forest Service's outreach and analyses including those conducted under the NEPA process. However, these important considerations are beyond the scope of this analysis. This report considers only what is in the best interest of wildlife.

3.0 ANALYSIS AREA AND POTENTIAL TRAIL ALIGNMENTS

3.1 ANALYSIS AREA

Figure 2-1 shows the proposed 83-mile Carbondale to Crested Butte trail system. Trail segment A, south of Carbondale, was completed in 2010. This report addresses the 20 miles of trail segments B and C in Pitkin County, north of McClure Pass. The analysis area focuses on wildlife use of the valley bottom where the trail would be located. It also extends outward to consider adjacent habitats of some species potentially affected by increased use of areas, which currently see little to no human use due to a lack of public access. The Crystal Trail has the potential to increase access to these areas both from people venturing off any new trail or as the result of new "social trails" (those trails created by recreational enthusiasts without any environmental review or authorization). The Roaring Fork Valley has a history of social trail development and limited capacity and enforcement from federal land management agencies has led to the continued use of these trails. Aerial photographic mapping of the Crystal River Trail corridor that was developed by PCOST for their January, 2017 public open house meetings is appended in Figures 10.1-1 to 10.1-10, in Section 10.1, below. Those maps show greater detail of corridor sections than the larger scale wildlife mapping.

3.2 POTENTIAL CRYSTAL RIVER TRAIL ALIGNMENTS

Currently, there are no proposed trail alignments. Potential trail segments will be identified and evaluated as part of PCOST's public outreach and the NEPA process. As a result, this analysis uses the most recent and detailed trail feasibility study to date as a basis for examining impacts to wildlife. Newland Project Resources (2004) identified several potential trail segments:

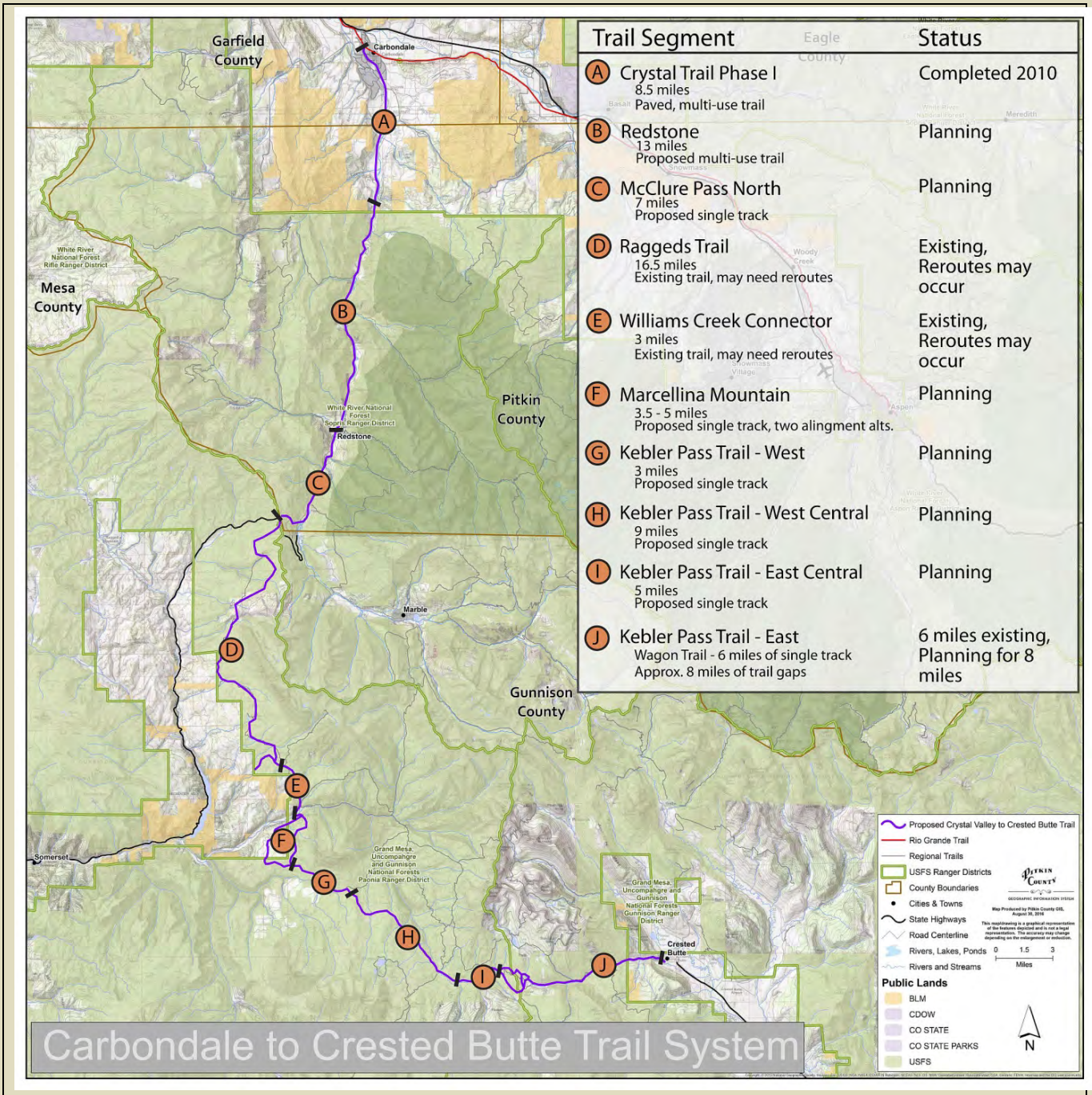

Figure 2-1. The proposed Carbondale to Crested Butte trail system. Trail segment A, south of Carbondale, was completed in 2010. This report addresses trail segments B and C in Pitkin County, north of McClure Pass. The map's dark green shading delineates the Maroon Bells-Snowmass Wilderness. Map developed by Pitkin County GIS, Aug. 30, 2016.

- First, an alignment offset from and along Highway 133, a two lane highway with posted speeds of between 55 mph and 30 mph, from south of Carbondale to the top of McClure Pass.
- Second, an alignment along discontinuous sections of an abandoned, historic railroad grade located east of the Crystal River. Portions of the railroad grade bisect private property where the grade is

used for subdivision access and driveways. However, the County has purchased parcels north of Redstone for use as open space that could physically accommodate three trail segments on the east side of the river (the Crystal River Open Space [CROS] trail segment, the Red Wind Point [RWP] segment, and Janeway and Filoha Meadows [J&F] segment) if accessed via new bridged river crossings.

- Third, an alignment through and north of Redstone along Redstone Boulevard, comingling with motorized traffic on the road.
- Fourth, south of Redstone, a trail alignment could occur along Highway 133 and diverge for two trail segments west of Highway 133, (1) following the abandoned Bear Creek railroad grade, bypassing Hayes Creek Canyon where a trail along the highway corridor was deemed unsafe (Newland Project Resources 2004), and (2) following the switchbacks of the historic McClure Pass Road.

Details and maps of each of these alignments are described in Newland Project Resources (2004, pp. 29-37). The trail feasibility study assumed trail segments north of Redstone would be paved and 8-10 feet wide to accommodate multiple user groups and trail segments south of Redstone would primarily be soft track and 3-5 feet wide. No final trail width or surface material decisions have been made by PCOST or any other entity. Because Newland Project Resources (2004) is the most recent and detailed trail feasibility study to date and because other potential routes have not yet emerged from the NEPA analysis, the above trail alignments will be considered, although this analysis is largely habitat-based.

4.0 METHODS

This analysis of potential trail effects is based largely on a synthesis of the large wildlife and ecological databases available for the Crystal River valley and the documented effects of recreational trail use on wildlife in the scientific literature. Considerable past effort and thought has been involved documenting seasonal wildlife use in the Crystal River valley. The results of key documents are summarized in Section 4.0, below. Of particular value were the (1) CPW seasonal wildlife mapping, (2) Crystal River Caucus Wildlife and Habitat Report (Crystal River Caucus 2007), (3) Pitkin County (2005, 2008) Management Plans for Crystal River parcels acquired as open space, and (4) CDOW/ CPW correspondence with Pitkin County on both the wildlife benefits associated with the open space parcel acquisitions and the subsequent wildlife concerns associated with the parcels' potential use as part of a regional trail system.

Current (updated Nov. 21, 2016 and Feb. 14, 2017) seasonal wildlife range maps were downloaded from CPW (http://cpw.state.co.us/learn/Pages/KMZ-Maps.aspx) for those species mapped with distributions overlapping the analysis area. Important limiting habitat types[2] were delineated on large-scale maps by Rocky Mountain Wild. Other more widespread habitats that would be less affected by potential trail effects and, therefore, less of a concern[3] are mentioned in the text, but not shown on figures, to focus graphics on the important ranges. The mapping downloaded from the CPW website was unaltered for this analysis. The larger map scale[4] used in this analysis was intended to provide an overview of important

[2] For example, big game winter range, winter concentration area, severe winter range, Pitkin County critical habitats, production areas, mineral licks, other concentration areas, migration corridors, migration patterns, nesting areas, etc.

[3] For example, overall range, summer range, resident population area, limited use area, summer concentration area, etc.

[4] For this analysis, the 20-mile Crystal River trail corridor was broken into three sections, compared to the 10 sections used for the January, 2017 Pitkin County open house displays. The purpose of this analysis was not to identify issues in great detail, that

wildlife habitats. The intent of this analysis was not to develop detailed mapping or identify other site-specific issues[5] in great detail; that will be done as part of the NEPA wildlife analysis.

March, 2017 field surveys were conducted along the length of the potential trail corridor to assess potential trail alignments, associated vegetation types and wildlife habitats, and to put the wildlife mapping in context. Sections of the railroad grade east of the river were hiked or driven where accessible and open.

Interviews were conducted with persons knowledgeable about Crystal River wildlife use. Of particular relevance were those with the former (Kevin Wright) and current (John Groves) CPW District Wildlife Managers (DWM) for the Crystal River valley, who clarified CPW seasonal wildlife range maps, provided details about wildlife numbers and use patterns, and provide other insights regarding local wildlife use. Both DWMs indicated that they provided the author the same information that they provided to the County and public.

5.0 FINDINGS OF PRIOR CRYSTAL RIVER TRAIL CORRIDOR ANALYSES

This section summarizes the findings of the more substantive and pertinent wildlife analyses and correspondence associated with the Crystal River Trail concept. Wildlife concerns have been one of the most important resource issues associated with the proposed trail. This extensive record (from the CDOW/CPW, PCOST, and the public), documents the critical, high value, and diverse wildlife habitats present and, in general, discourages placing trail segments east of the Crystal River.

5.1 1994 CRYSTAL RIVER VALLEY BICYCLE TRAIL STUDY

The PCOST Board began researching the open space and trails needs in the Crystal River valley in June, 1992. Important flora and fauna maps were developed and many public meetings were held in 1992 and 1993 to obtain the opinions of landowners, valley residents, and bicyclists on various trail, biking, and open space issues. The Crystal River Valley Bicycle Trail Study (Haefeli 1994) documented the results of what was the first, major, trail planning effort by Pitkin County. Constraints and potential improvements associated with locating a trail along Highway 133, trail segments east of the river, and off highway trail segments west of Highway 133 were conceptually identified. Other areas of further study were also identified.

With respect to wildlife, wildlife mapping was relatively crude (back then), but the same ancestor polygons of bighorn sheep (*Ovis canadensis canadensis*), elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), black bear (*Ursus americanus*), etc. were shown in the same locations as they are today. In their comments on the Crystal River Valley Bicycle Trail Study, the CDOW (as cited in Haefeli 1994, pp. 38-39) identified the following concerns associated with a trail east of Highway 133 that are pertinent to the current analysis area:

- "Large game winter by river and are more stressed by pedestrians and cyclists than motorists. (Winter Concern)
- While grading for trail fill, debris may fall into the river.

will be done as part of the NEPA wildlife analysis, but to provide an overview of important wildlife habitats and related issues.

[5] For example, active raptor nests, Lewis' woodpecker nests, or bat roosts that might be avoided and buffered by trail siting.

- There will be impacts to riparian and aquatic vegetation. Marsh areas are very sensitive to impacts and may require extensive mitigation.
- Vegetation removal may cause erosion and degrade water quality.
- If the trail were to include equestrian use, there could be an increase in animal waste entering into the river. Animals may also impact the health or amount of riparian vegetation in these sensitive areas."

5.2 1996-1999 ROARING FORK WATERSHED BIOLOGICAL INVENTORY, CNHP

In 1996, Pitkin County, in partnership with Aspen Wilderness Workshop (now Wilderness Workshop) and the Roaring Fork Valley Audubon Society, contracted the Colorado Natural Heritage Program (CNHP) to assess the natural heritage values of lands in the Roaring Fork valley. That three-year effort was funded by two GOCO grants awarded to Pitkin County, as well as financial support from Roaring Fork watershed county, city and town governments. The primary goal of the project was to identify the locations of rare or imperiled plants, animals, and significant plant communities. The CNHP (Spackman et al. 1999) identified 55 potential conservation areas (PCAs) in the Roaring Fork watershed that required protection to ensure the watershed's natural heritage was not lost. The three PCAs in the Crystal River valley and their elements that could be affected by potential trail segments are summarized below (Fig. 5-1). Four other PCAs (Middle Thompson Creek, Avalanche Lake, East Creek, and Big Kline Creek) were also identified in the Crystal River valley for their rare or imperiled plants, significant plant communities, and animal elements. However, those four PCAs are removed or isolated from the Crystal River valley bottom such that whatever potential trail segments and anticipated trail use that may be approved through the NEPA process are unlikely to affect them, including social trail development..

5.2.1 Crystal River at Potato Bill Creek

This PCA is a narrow, 21-acre area between Highway 133 and the Crystal River. Because of its small area and linearity it is not discernable in Figure 5-1. Land ownership is unknown. It was designated to protect the rare canyon bog orchid (*Plantathera sparsiflora* var. *ensifolia*) from road maintenance activities. This PCA could be affected by a highway trail alignment.

5.2.2 Avalanche Creek

This PCA includes a ± five-mile reach of Avalanche Creek and a ± 3.5-mile reach of Bulldog Creek that extend down to the Crystal River. A potential section of the J&F trail segment east of the river following the railroad grade, including the spur up and over the saddle to avoid the geologic hazard north of Avalanche Creek, would bisect the western tip of this PCA. Animal elements of significance documented in the PCA include Colorado River cutthroat trout (*Oncorhyncus calrki pleuriticus*, a WRNF Region 2 [R2] sensitive species), nesting black swifts (*Cypseloides niger*, a WRNF R2 sensitive species), critical bighorn sheep and elk winter ranges, and western small-footed myotis (*Myotis ciliolabrum*; a bat).

5.2.3 McClure Pass

This PCA includes 2,174 acres at the top of McClure Pass, mostly on the south side, outside of the Carbondale to McClure Pass analysis area. From a wildlife perspective, this PCA is of value because its large, mature aspen stands support nesting purple martins (*Progne subis*, a WRNF R2 sensitive species).

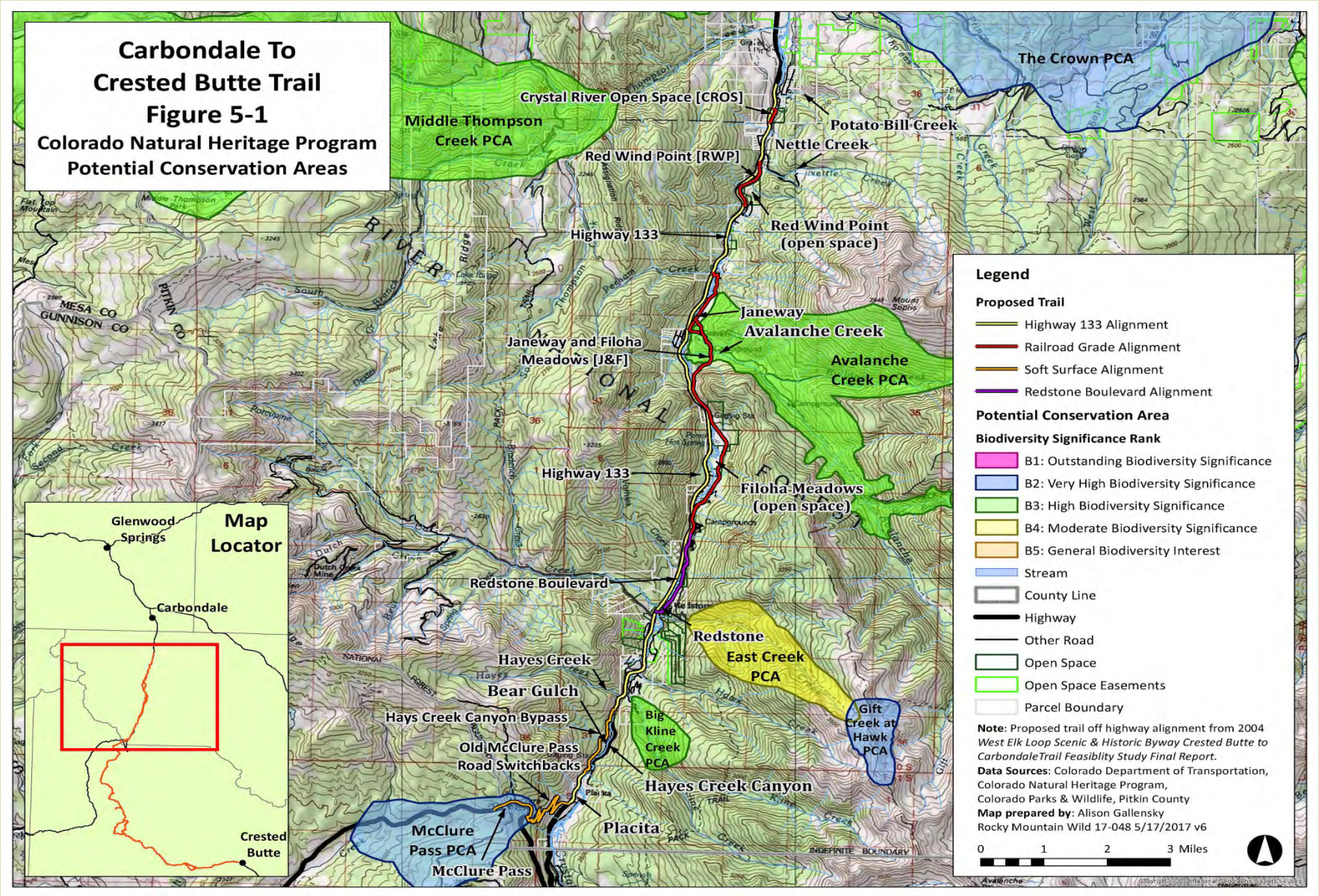

Figure 5-1. CNHP (Spackman et al. 1999) potential conservation areas in the Crystal River valley that could be affected by potential trail segments.

5.3 2004 WEST ELK LOOP SCENIC & HISTORIC BYWAY CRESTED BUTTE TO CARBONDALE TRAIL FEASIBILITY STUDY

The West Elk Loop Scenic & Historic Byway Crested Butte to Carbondale Trail Feasibility Study (Newland Project Resources 2004) was conducted to explore and determine the feasible options for the design and construction of a non-motorized recreation and transportation trail to accompany the byway. "Feasibility" was defined to mean an alignment that is physically capable of being implemented and capable of being successfully utilized. As further defined, a feasible alignment appears to have no fatal flaws that would prohibit its use based on the preliminary environmental information obtained in the field, through existing or known assessments or studies, and through discussions with authorities or experts knowledgeable of the area.

The feasibility study indicated that the Crystal River Trail would be managed as a "three-season" facility. General wildlife-related design criteria included

- Minimizing user impacts to wildlife
- Protecting habitat values and the river corridor
- Minimizing environmental impacts during construction
- Identifying sensitive natural areas and recommending mitigation measures
- Trail alignments avoiding or mitigating sensitive habitats
- Considering seasonal closures and providing seasonal detour routes if possible

None of the various alignments described in the feasibility study were preferred or favored over another. With the exception of Hayes Creek Canyon, where a 1.5-mile bypass was identified, the feasibility study determined that a bike trail could be safely located alongside, or offset from, the Highway 133 corridor through the entire length of Pitkin County's Crystal River Trail analysis area (Newland Project Resources 2004, T. Newland, Newland Project Resources, pers. comm., Mar.23, 2017).

The first issue of concern listed for the Crystal River section of the trail corridor was "the potential impacts of the trail to critical wildlife habitat, especially mountain sheep and elk" (Newland Project Resources 2004, p. 5). Because Newland Project Resources (2004) represents the most recent and thorough trail planning analysis to date and because other potential routes have not yet emerged from the NEPA analysis, trail corridors identified in that analysis are considered in this analysis and shown on the appended wildlife maps in Section 10.3.

5.4 2007 CRYSTAL RIVER CAUCUS WILDLIFE AND HABITAT REPORT

The Crystal River Caucus is an advisory board to the Pitkin County commissioners, giving Crystal River residents an opportunity to voice their opinions on a variety of local issues. In 2007, the Caucus commissioned an inventory and assessment of wildlife habitat in the Crystal River valley for their consideration in determining appropriate management, development, and recreational trail plans for the valley (Crystal River Caucus 2007). The report was prepared by professionals and unpaid professionals with backgrounds in wildlife, biological, and environmental sciences. The primary purpose of the study was to identify and evaluate areas that qualified as "critical habitat" (under definitions used in Pitkin County Land Use Code) in the Crystal River valley. The report stated that the analysis focused on the

relatively unfragmented, intact County Open Space and NFS lands buffered from human activities by the Crystal River since approximately 1942 (65 years), now supporting bighorn sheep, elk, and a wide variety of other wildlife.

The Crystal River biological analysis divided the 18-mile analysis area into six, three-mile study or heritage areas (Placita, Redstone, Filoha Meadows, Avalanche Creek, Red Wind Point, and Thompson Creek). Element occurrences within each of the heritage areas were grouped in the following four categories and quantified following CNHP and CDOW rankings:

- Plant habitat and vegetation
- Rare and imperiled (threatened) species and communities
- Wildlife activity use areas
- Stream and riparian(streamside) habitat health

The wildlife component of the analysis was based, in part, on Natural Diversity Information System (NDIS) mapping[6] obtained from the CDOW. The CDOW assigned relative importance values of 1 to 5 for each seasonal activity (e.g., winter range=4, summer range=2, production area=5, winter concentration area (WCA) and severe winter range (SWR)=5, etc., called Impact Factors). By totaling the impact factors in a heritage area, an objective measure of importance and potential impact was determined for that area that contributed to the overall ranking (i.e., for all 4 categories) for the heritage area. Quantifying wildlife activity was used as a general indicator of high wildlife value areas. Colorado Division of Wildlife mapping was not altered despite animal sightings indicating that some seasonal ranges are more extensive than the mapping showed.[7]

Sixteen species of wildlife were mapped by CDOW in the Crystal River Valley and their seasonal ranges were ranked. Maps were only provided in the report for bighorn sheep. Polygons of the more important sheep habitats (winter range, winter concentration area, severe winter range, and production areas) shown in the 2007 report were the same or similar to those downloaded from CPW (last updated Nov. 21, 2016)[8] for this Wilderness Workshop analysis, with the possible exception that there were no sheep severe winter ranges mapped in 2007 as there are now.[9]

Tables 5-1 and 5-2 show the Crystal River Caucus (2007) results of the relative habitat value rankings and potential impact for bighorn sheep and elk, respectively, in the six heritage areas composing the Crystal River analysis area.

[6] The last ancestor of current CPW GIS .kmz file mapping.

[7] A CDOW disclaimer associated with the NDIS mapping indicated that polygons represent the area where 90% of the animals occur during a specified period and it is recognized that a small subset of animals occur outside defined polygons.

[8] CPW mapping is now updated every five years. Because there were few, if any, habitat or land use changes between 2007 and 2016, mapping would be expected to change little.

[9] Sheep severe winter range (SWR) is identified in figure legends in the 2007 wildlife report, but no SWR polygons appear in any figure. However, sheep SWR occurrence is mentioned in the text for the Red Wind Point heritage area. In addition, 2008 was a winter that met CDOW SWR criteria (see definition in Section 10.2.1) and mapping after that date may have been further refined to reflect that.

Table 5-1. Bighorn sheep habitat importance/ impact potential rankings in the six heritage areas defined by Crystal River Caucus (2007) in the Crystal River analysis area.

Sheep Activity Area	Thompson Creek	Red Wind Point	Avalanche Creek	Filoha Meadows	Redstone	Placita
Overall Range	0	2	2	2	2	2
Winter Concentration Area	0	5	5	5	0	0
Production (lambing)	0	5	5	5	5	5
Winter Range	0	4	4	4	4	4
Summer Range	0	2	2	2	2	2
Grand Total	**0**	**20**	**20**	**20**	**15**	**15**

Source: Crystal River Caucus (2007).

Table 5-2. Elk habitat importance/ impact potential rankings in the six heritage areas defined by Crystal River Caucus (2007) in the Crystal River analysis area.

Elk Activity Area	Thompson Creek	Red Wind Point	Avalanche Creek	Filoha Meadows	Redstone	Placita
Severe Winter Range	2	2	4	4	4	4
Winter Concentration Area	2	2	5	5	5	5
Winter Range	3	3	3	3	3	3
Production (calving)	0	0	5	5	5	5
Summer Range	0	0	2	2	2	2
Highway Crossing	0	0	0	0	0	2
Overall Range	1	1	1	1	1	1
Grand Total	**10**	**10**	**22**	**22**	**22**	**24**

Source: Crystal River Caucus (2007).

The Crystal River Caucus (2007) defined the following relative impact potential categories for totals in each heritage area:

- Low: 9-14
- Moderate: 15-19
- High: 20-25

Five of the six sheep analysis areas were of high (Red Wind Point, Avalanche Creek, and Filoha Meadows) and moderate (Redstone and Placita) importance/ vulnerability, while four of the six elk areas were of high (Avalanche Creek, Filoha Meadows, Redstone, and Placita) importance/ vulnerability.

Table 5-3 shows the Crystal River Caucus (2007) summation of the overall biological value of the six heritage areas composing the Crystal River analysis area. These results consider four components: plant habitat, imperilment, wildlife activity, and stream/riparian values. See Crystal River Caucus (2007) for methods.

Table 5-3. Relative biological importance rankings of overall plant habitat, imperilment, wildlife activity, and stream/riparian values in the six heritage areas defined by Crystal River Caucus (2007) in the Crystal River analysis area.

Biological Component	Thompson Creek	Red Wind Point	Avalanche Creek	Filoha Meadows	Redstone	Placita
Plant Habitat	3	5	5	5	5	5
Imperilment	4	4	5	5	4	4
Wildlife Activity	5	8	9	10	9	8
Stream/Riparian	1	2	2	3	2	4
Composite Total	**13**	**19**	**21**	**23**	**20**	**21**
Critical Habitat Final Rank	**6**	**5**	**2**	**1**	**3**	**2**

Source: Crystal River Caucus (2007, Table 7-2).

The highest values were associated with Filoha Meadows, Avalanche Creek, and Placita with total values of 23, 21, and 21 (out of 25), respectively. The Crystal River Caucus (2007) analysis found Filoha Meadows and Avalanche Creek particularly vulnerable to incompatible development and activity because of the seasonal elk and bighorn sheep activities and their composite impact scores.

As a result of their analysis, the Crystal River Caucus (2007) provided a summary of recommendations, some of which are particularly pertinent to this analysis:

- "That accessing designated critical Open Space and Forest Service lands with high impact bicycle thoroughfare trails is not appropriate.
- That appropriate public access of critical habitat, Open Space, and U.S. Forest lands include minimal impact recreation and educational activities compatible with wildlife use patterns.
- That seasonal closures are not sustainable in protecting the winter range of elk and bighorn sheep and cannot be used to mitigate the impact of a bike-pedestrian trail.
- That the best long term use of the dedicated property tax is to include the proposed trail on a safe and expanded shoulder of Highway 133 and avoiding [critical] wildlife [habitats]."

The Crystal River Caucus endorsed the Crystal River Trail, as long as it would be located within the Highway 133 corridor.

The Crystal River Caucus (2007) also made the following recommendation to PCOST:

> "The Task Force recommends that no provision be made for including a trail alignment through Pitkin County Open Space within the Crystal River Valley. There should be no plans for a bicycle/ pedestrian trail in the management plans for the Red Wind Point, Filoha Meadows Heritage Areas or other county open spaces. It is recommended that only minimal impact activities, compatible with existing wildlife patterns, be included. This will provide access into Open Space for the taxpayer and allow the recreation and educational return they deserve, while protecting wildlife and habitat."

The Crystal River Caucus (2007) report contains a great deal of additional site-specific trail and road alignments, closures, and other recommendations to minimize future human use impacts on plant and

animals resources of high value and sensitivity. These details should be considered as part of the NEPA process.

5.5 PITKIN COUNTY MANAGEMENT PLANS FOR CRYSTAL RIVER PARCELS

Pitkin County Open Space and Trails properties are governed by Title 12 of the Pitkin County Code, which establishes general rules that apply to all of the open spaces and trails within the system (Fig. 5-2). In general, it is the set of regulations that prohibits motorized vehicles on open spaces and trails with some limited exceptions, prohibits fires, camping and hunting, requires dogs on leashes and picking up and properly disposing of dog waste.

In addition to Title 12, the use of some open space properties is governed by an adopted management plan that is specific to a particular property. The plans outline resource protection and allowed uses. Two PCOST parcels that might be impacted by a trail up the Crystal Valley have site-specific management plans and are relevant to this analysis: Red Wind Point and Filoha Meadows. Both are summarized below.

5.5.1 Red Wind Point Management Plan

The 65-acre Red Wind Point (RWP) Open Space protects critical bighorn sheep winter range and provides a unique recreation experience on the former Crystal River railroad grade along the Crystal River (Fig. 5-3). The CDOW identified this property ca. 1992 as extremely important to preserve due to the critical winter range of the upland dry meadow and upper slopes for bighorn sheep. From December through April, bighorn sheep forage on the upper sections of the property. Many other wildlife species use RWP for forage and breeding sites.

The 2005 RWP Management Plan indicates that this parcel meets the goals of the PCOST program by protecting wildlife habitat and scenic open space and by providing recreational access to the Crystal River and the 1.25-mile trail along the former Crystal River Railroad grade. Two of the five RWP Management Plan's resource management goals (p. 1) are relevant to this analysis:

- "Protect and enhance the bighorn sheep habitat"
- "Provide a multi-use trail along the former Crystal River Railroad grade"

The RWP Management Plan also indicates that:

- "One of the main reasons for the purchase of RWP is to protect wildlife habitat" (p. 6).
- "To protect bighorn sheep habitat, the upper slopes and dry meadow will be closed year-round to public use and a seasonal closure of the entire property will be implemented from December 1 - April 30… This closure is necessary because the wildlife characteristics of the upper portions of the property necessitate limiting public access to the trail along the former Crystal River Railroad grade and allowing sheep access to the river during the winter" (p. 7).

5.5.2 Filoha Meadows Management Plan

Pitkin County Open Space and Trails conducted five years of intensive study of the local natural resource values to acquire the level of knowledge needed to prepare the 2008 Filoha Meadows Management Plan. Detailed vegetation and wildlife reports are appended to the plan. Protection and enhancement goals for the property (Fig. 5-4) were outlined in the Plan with careful allowance made for visitors to experience one

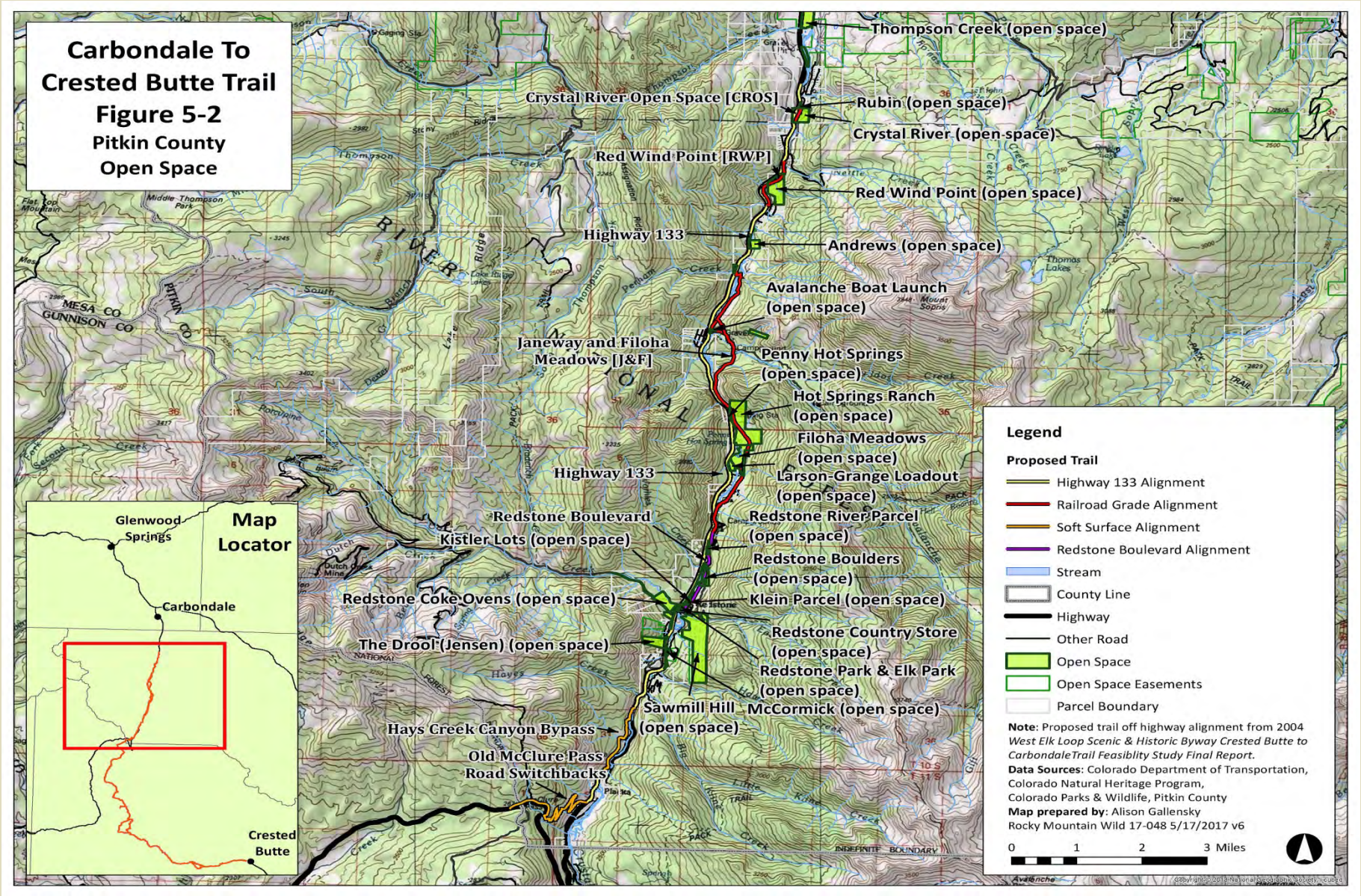

Figure 5-2. Pitkin County Open Space parcels in the Crystal River valley analysis area.

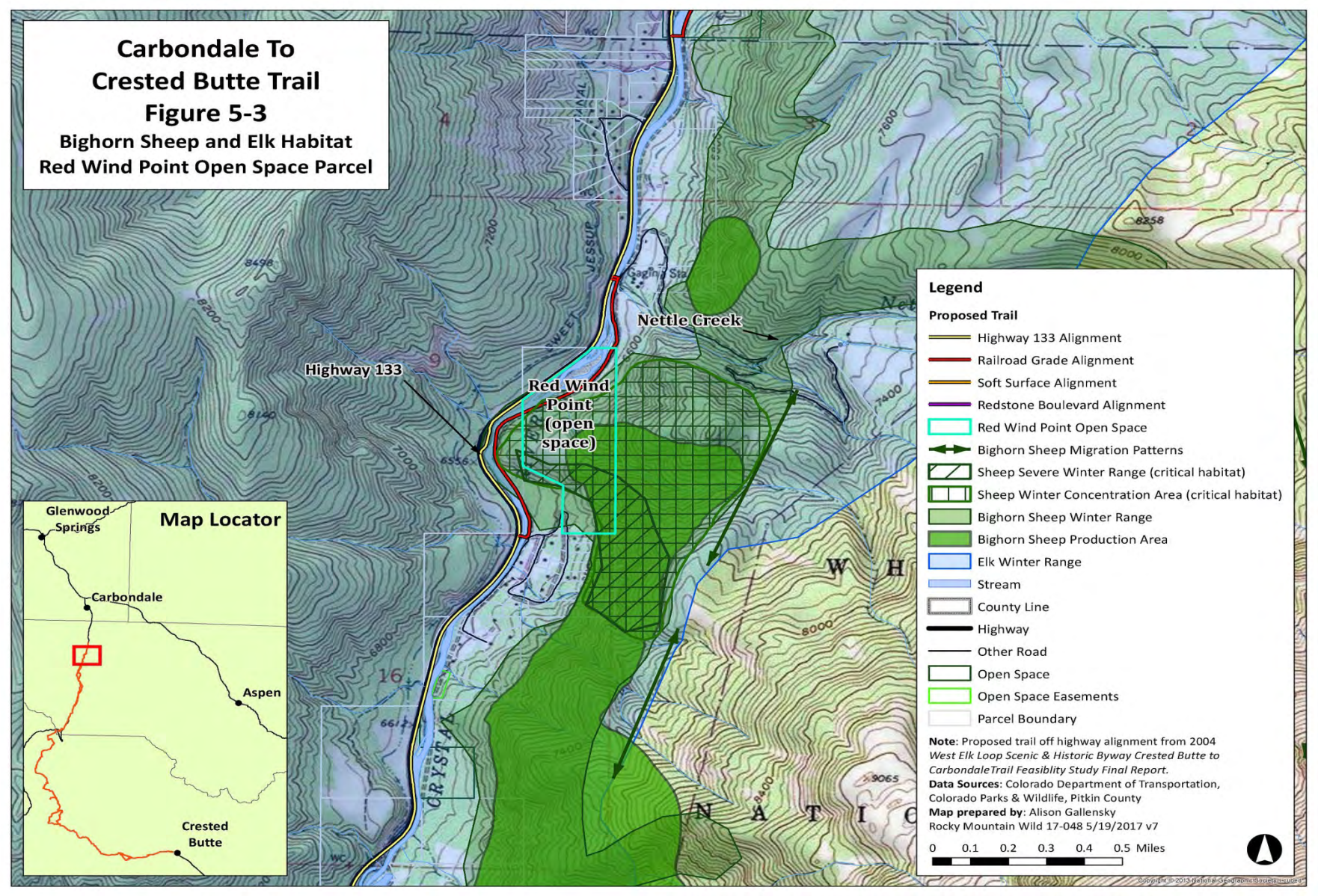

Figure 5-3. Bighorn sheep and elk seasonal ranges overlapping the Red Wind Point Open Space parcel.

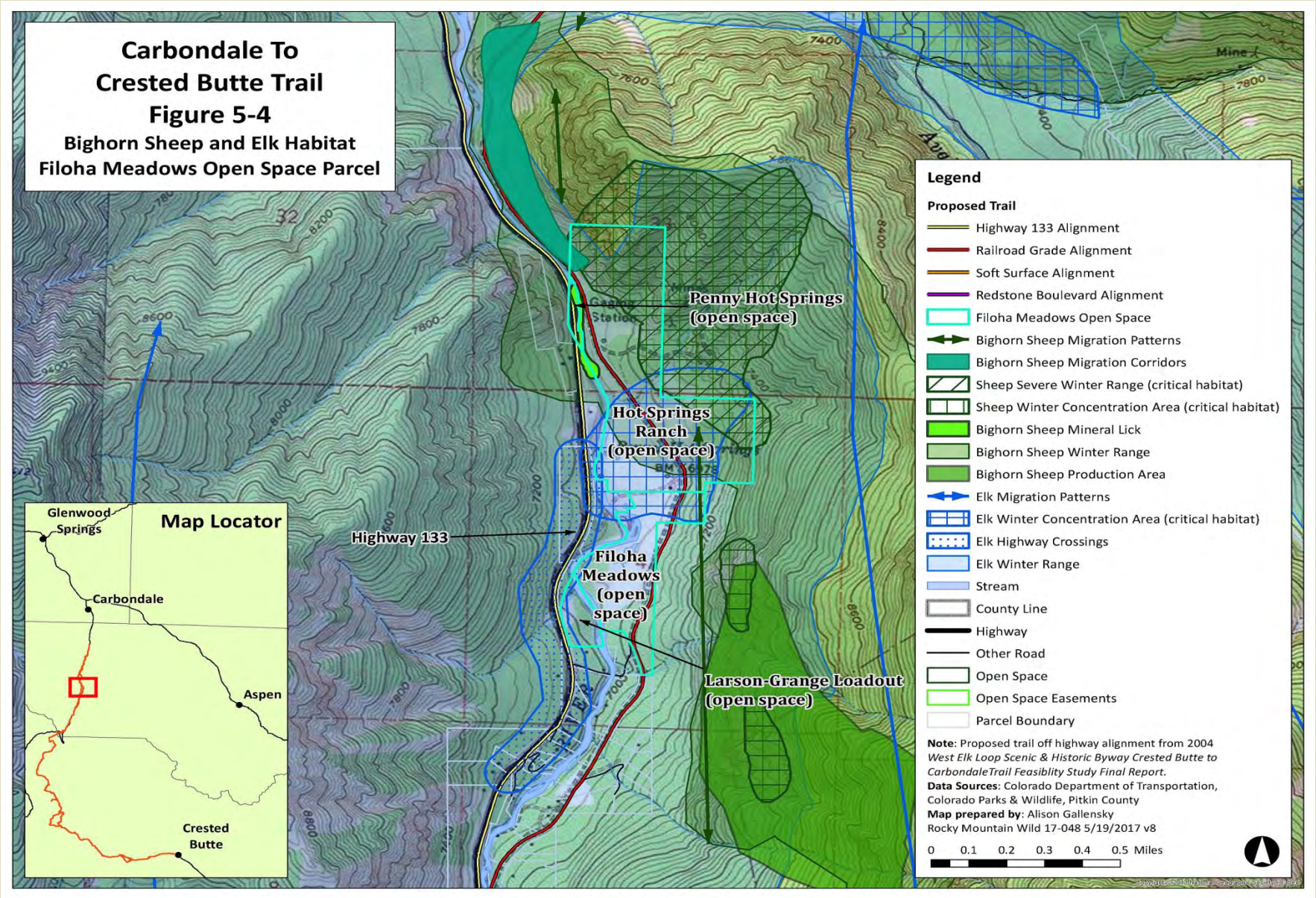

Figure 5-4. Bighorn sheep and elk seasonal ranges overlapping the Filoha Meadows Open Space parcel.

of the most beautiful and biologically diverse places in Colorado.

From the 2008 Filoha Meadows Management Plan's Introduction:

- Filoha Meadows Nature Preserve is comprised of three distinct acquisitions; 1.5-acre "Penny Hot Springs" (1991), 140-acre Hot Springs Ranch (2001), and 50-acre Filoha Meadows (2003), which protects over one mile of the Crystal River Valley from development.
- The property contains unique ecological communities due to the hot springs and geothermal activity underlying the property. The geothermal activity results in snow free meadows, providing critical winter range for bighorn sheep and elk. Elk calve near the Crystal River, beavers create wetlands, and predators like coyotes and foxes use the meadows for their hunting grounds. Filoha Meadows exemplifies the PCOST's mission of protecting areas with outstanding scenic, natural, and wildlife habitat values. The management of Filoha will protect and enhance the meadows and riparian habitat that are so important to wildlife. It will also provide soft surface nature trails and the opportunity for environmental education highlighting the extensive wetland and riparian habitat that exists on Filoha.

The three Filoha Meadows Management Plan's resource management goals include:

- To study, protect, and enhance the ecological communities with particular emphasis on those that are unique and rare.
- Enhance the outstanding wildlife habitat values.
- Provide low impact environmental education.

The Plan's Recreation Potential section indicated that prior to the adoption of the Plan, the property was closed to the public except for environmental education programs and the Penny Hot Springs, located on the west side of the Crystal River along Highway 133. This closure of the main property east of the river allowed PCOST to study the property without any additional human impacts. According to the Plan, this closure has been successful with very few violations witnessed by OST staff, CDOW, and local citizens. All reported violations have been prosecuted.

Based on results of the vegetation and wildlife studies, and considering CDOW/CPW recommendations (see Section 5.7) two travel management corridors have been established to limit human disturbance on the property and provide limited public access. The entire property on the east side of the Crystal River, including both travel management corridors, has a seasonal closure to protect critical bighorn sheep and elk habitat from October 1 – June 30. The Plan indicates that this closure will be strictly enforced through PCOST rangers and CDOW personnel, that there is zero tolerance for violations of the closure, and all violations will be prosecuted. The Plan indicates that PCOST will work to create a full-time seasonal ranger position, subject to budget approval, to regularly patrol PCOST property in the Crystal Valley.

Travel Corridor A follows the historic Crystal River railroad alignment paralleling the river through the meadows. There is a night closure of this trail from ½ hour before sunset to ½ hour after sunrise, presumably because wildlife were thought to mostly use this property at night. To minimize potential recreation management problems; neither equestrians nor bicycles are allowed on this trail.

Travel Corridor B is an old road from the south that leaves the rail bed and traverses downhill to a viewing blind. To protect the fragile wetlands, public access to Travel Corridor B will be limited to environmental education programs guided by staff or trained volunteers.

Dogs and all types of domestic pets/livestock are prohibited on the entire property to protect wildlife on the east side of the Crystal River and to protect the health and visitor enjoyment on the west side of the Crystal River. The Plan indicates that this restriction is strictly enforced with a zero tolerance policy.

5.6 CDOW/ CPW RECOMMENDATIONS RE: THE CRYSTAL RIVER TRAIL

This section summarizes public correspondence from the state wildlife management agency regarding important seasonal wildlife use areas, parcels, and CDOW/CPW concerns and recommendations a recreation trail in the Crystal River valley.

5.6.1 Feb. 25, 2002 Letter to GOCO re: Filoha Meadows Acquisition

Mr. Pat Tucker, CDOW Area Wildlife Manager, sent a February 25, 2002 letter to the State Board of GOCO in support of an open space grant application submitted by Pitkin County to acquire Filoha Meadows. Mr. Tucker noted the important elk and bighorn sheep winter range, riparian/ wetland habitat, and variety of small mammals, songbirds, waterfowl, raptors, wintering bald eagles, black bear and mountain lions using the parcel. Mr. Tucker further noted this was an excellent opportunity to preserve significant wildlife habitat in the face of great development pressures in the Roaring Fork and Crystal River valleys.

5.6.2 Dec. 19, 2003 Letter to PCOST re: Filoha Meadows Trail Use

In response to a December 3, 2003 clarification request from Mr. Dale Will, Director, PCOST, regarding the CDOW's position on public access to Filoha Meadows, Mr. Tucker responded in a Dec. 19, 2003 letter. Mr. Tucker emphasized that his February 25, 2002 letter of support of the GOCO proposal "was based entirely on protecting this critical area for wildlife." In addition to clarifying the CDOW's support of the parcel's acquisition, Mr. Tucker described the seasonal importance of this area to sheep and elk, the susceptibility of sheep to human-caused disturbances, the decline in lamb survival, and the need to avoid additional detrimental impacts to this sheep herd.

In his Dec. 19, 2013 letter, Mr. Tucker indicated that the CDOW believed a viable multi-use trail alternative exists that would have much less of an impact on wildlife. He described an alignment along Highway 133 on the west side of the Crystal River that would allow hikers and bikers to enjoy the scenic qualities and wildlife diversity of this area year-round with a minimal disturbance to wildlife using the area. His letter stated that trail could also be open year-round instead of the limited 4.5-month period (July 1 to Nov. 14) that the railroad trail would be subject to a seasonal closure to reduce impacts on bighorn sheep and elk.

He also indicated that the CDOW believes that a nature trail behind the Filoha Meadows cabins could provide the public with an educational experience and access to the beaver ponds blind. "This "minimal" impact trail could provide a valuable experience to wildlife viewers and educators while being limited in duration and season of use" (p. 2, para. 4). Such a trail would provide for the needs of trail users and their expectations as stated in the GOCO grant proposal while protecting wildlife, also a component of the GOCO proposal. This recommendation was later adopted as the type of use allowed on the parcel per the Filoha Meadows Management Plan, above.

Mr. Tucker went on to state that "it remains our professional judgement that a developed trail on the railroad right-of-way would be detrimental to wildlife and, for all the reasons above we strongly urge

that it not be built there." Mr. Tucker went on to offer recommendations for reducing potential, trail-related wildlife impacts, but indicated that trail closures are ineffective, unenforced, and even low levels of noncompliance can displace animals from critical habitats.

5.6.3 March 31, 2008 Letter to PCOST re: Filoha Meadows Draft Management Plan

Mr. Perry Will, CDOW Area Wildlife Manager, sent a March 31, 2008 letter to Mr. Gary Tennenbaum, PCOST, commenting on the Filoha Meadows Draft Management Plan. The CDOW expressed great concern about allowing unlimited travel along this corridor even with a proposed seasonal closure and trail regulations, which, in the CDOW's experience, are ignored by a sufficient portion of the public to where the wildlife values are eventually lost. The CDOW noted the increased wildlife use of the parcel due to lack of disturbance and high quality habitats present. The CDOW reiterated their 2003 recommendation that public access to Filoha Meadows be restricted and consistent with the management desire to provide low impact educational opportunities by allowing only guided educational and interpretive program, as have been occurring. The CDOW expressed concern about adaptive management and changing personnel, political agendas, social desires, and recreation pressures changing, leading to altered management policies that are inconsistent with preserving the important wildlife and ecological values for which Filoha Meadows was originally acquired. It was recommended that wildlife values on the property be protected as intended by the property's purchase.

5.6.4 Dec. 26, 2006, Groves, Seasonal Closure Memo to Crystal River Wildlife Task Force

Mr. John Groves, current Crystal River CPW DWM, wrote a memo to the Crystal River Wildlife Task Force regarding the limited effectiveness and enforcement seasonal closures and that it is often local residents that are violating the closures.

5.7 PERTINENT PCOST CORRESPONDENCE

5.7.1 Dec. 8, 1992 Pitkin County Memo re: Filoha Meadows Open Space Trail and Wildlife

In a December 8, 1992 memorandum to the Pitkin County Planning and Zoning Board, Ms. Mary Lackner, Pitkin County Planner, wrote that the issue of purchasing part of the old railroad grade at Penny Hot Springs needs to be discussed further because "the board stated at its last meeting that it would recommend that no trail be placed through the property because of potential wildlife and visual impacts."

5.7.2 Dec. 14, 2003 PCOST Memo re: Filoha Meadows Open Space Trail and Wildlife

In a December 14, 2003 memorandum to Mr. Dale Will (PCOST Director), Pitkin County's Wildlife Biologist clarified wildlife concerns associated with a conceptual trail crossing Filoha Meadows. He identified the unique sheep habitat present, the recent decline of the herd due to hundreds of acres of winter range losses to subdivision development, recreation, and free-ranging dogs, and the sensitivity of sheep to human recreation. He also noted the unique and critical elk habitats present and provided examples of the negative effects that recreationists can have on elk. He concluded that "it is incumbent upon the County to actively pursue a bicycle trail alignment that will completely avoid the east side of the Crystal River at Filoha Meadows Open Space." If it was impossible to construct a trail on the west side of the river, wildlife impacts from a trail east of the river could be reduced via a November 1 through July 1 seasonal closure. However, it was noted that such "seasonal closures are very difficult to

enforce" and both he, CDOW (Kevin Wright), and USFS (Phil Nyland) personnel observed numerous seasonal closure violations on other Crystal River open space parcels. Lastly, he noted that primitive education trails on Filoha Meadows that would be used between July 1 and November 1 would be unlikely to have any significant negative impacts on wildlife or wildlife habitat.

5.8 OTHER PERTINENT PUBLIC CORRESPONDENCE

5.8.1 Dec. 19, 2006, Seidel, Seasonal Closure Memo to Crystal River Wildlife Task Force

Mr. John Siedel, former CDOW Area Director, wrote a memo to the Crystal River Wildlife Task Force on the sustainability of seasonal closures and their limited effectiveness and enforcement.

5.8.2 Dec. 20, 2006, Wright, Seasonal Closure Memo to Crystal River Wildlife Task Force

Mr. Kevin Wright, former Crystal River CDOW District Wildlife Manager (DWM), wrote a memo to the Crystal River Wildlife Task Force on the public's non-compliance with seasonal closures, their limited effectiveness and enforcement, and how just a few violations can change and negatively affect big game winter range use.

5.8.3 Nov. 15, 2015, Wright, Ltr. to Pitkin County BOCC and PCOST

Mr. Kevin Wright, former, 31-year, Crystal River and Aspen District, CDOW DWM, wrote a letter of concern to the Pitkin County Board of County Commissioners (BOCC) and PCOST regarding the way the Roaring Fork Valley was progressing with respect to recreational pressures and its impact on wildlife resources. He indicated that Pitkin County has one of the strongest land use codes for protecting wildlife in Colorado and has been very good at implementing the Code for private development. However, the land use emphasis on public lands in the last 5-10 years "has become recreation at all costs with very little regard to the impacts it is having on our wildlife resources and their habitat. The dramatic increase in recreation and endless trail building is having significant negative impacts to wildlife. Impacts are often considered but are often dismissed as non-significant or believed they can be "mitigated"." He noted the collective effects of habitat lost to development, habitat maturation, an inability to improve forage conditions, and the dramatic increase in recreational pressure are having negative effects on mule deer and elk population demographics to where the deer population is at the lowest level it has been in 40 years. He summarized the types of impacts to wildlife that result from trail construction and use and how these effects are well established in the scientific literature. He commented on the double standard that exists in the Pitkin County Code between trails proposed on private vs. public lands. He provided more examples of how mitigation, including seasonal closures, do not work. Lastly, he lamented that "We are always compromising wildlife values for peoples' benefit and then we compromise the compromise," before requesting a balance between recreation and wildlife considerations.

5.8.4 Mar. 23, 2017, Wright, Ltr. to PCOST and Pitkin County BOCC

Mr. Kevin Wright, former, 31-year, Crystal River and Aspen District, CDOW/CPW DWM, wrote another letter to PCOST and the Pitkin County BOCC to provide input since the proposed Crystal River Trail was starting the analysis phase. He noted that the least environmentally damaging trail alignment is along the Highway 133 ROW on the west side of the river. He stated that if the trail is placed there, there would be minimal impact to the environment and wildlife, it would allow

unrestricted use of the trail year-round, and meet the Governor's goal. In his opinion, placement of the trail along the old railroad grade on the east side of the river **will have significant negative impacts to wildlife and the environment** (emphasis in original). He described areas of particular importance to elk, deer, and sheep, how their populations are severely stressed in the Roaring Fork and Crystal River valleys, and how a trail east of the river would negatively affect them. He provided additional[10] results of scientific studies that assessed recreational effects on wildlife and refuted the notion that "the science is still out." He repeated his concern about ineffective seasonal closures.

6.0 WILDLIFE USE OF THE CRYSTAL RIVER VALLEY

This section characterizes wildlife use of the Crystal River valley based largely on the large wildlife and ecological databases. Seasonal CPW mapping was conducted consistently over the entire analysis area for a limited number of species, as were the broader ecological and wildlife surveys conducted by the Crystal River Caucus (2007). Elsewhere, extremely thorough and detailed vegetation and wildlife analyses are available (e.g., for Filoha Meadows), but only for a limited number of areas. For most species that are not mapped, they are assumed to be present if suitable habitat is present, following USFS policy. Species are addressed in the categories in which they are addressed in USFS NEPA documents.

6.1 THREATENED, ENDANGERED, AND PROPOSED WILDLIFE SPECIES

Federally listed and proposed animal species that were initially considered in this analysis included those identified by the U.S. Fish and Wildlife Service's (USFWS) on-line Information, Planning, and Conservation (IPaC) decision support system for the Crystal River Trail analysis area on March 29, 2017. The analysis area was defined as a 118 square mile area between the distal end of the existing Crystal River Trail to McClure Pass and adjacent portions of the Crystal River watershed. This area would contain most of the potential direct and indirect effects associated with the proposed Crystal River Trail. Uncompahgre fritillary butterfly (*Boloria acronema*), humpback chub (*G. cypha*), bonytail chub (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), greenback cutthroat trout (*Oncorhynchus clarkii stomias*), Mexican spotted owl (*Strix occidentalis lucida*), yellow-billed cuckoo (*Coccyzus americanus*), North American wolverine (*Gulo gulo luscus*), and Canada lynx (*Lynx canadensis*) were identified. With the exception of lynx, none of these 10 species identified are known or suspected of being present in the analysis area, nor would they be affected by management decisions associated with the proposed trail. There is no designated critical habitat for Federally-listed species that would be affected by the proposed trail.

6.1.1 Canada Lynx

The Canada lynx has been classified by the State of Colorado as a State endangered species since 1976. The lynx was listed in the contiguous United States as threatened, effective April 23, 2000 (65 FR 16052). Lynx are native to Colorado, however the population was considered non-viable in the 1990's. The CDOW began releasing lynx back into southern Colorado in 1999. During 1999-2006, a total of 218 wild-caught lynx from Canada and Alaska were released. On September 17, 2010, the CDOW announced that the lynx reintroduction project had successfully accomplished its goal of establishing a

[10] From Mr. Wright's Nov. 15, 2015 ltr.

breeding population in the Southern Rockies (CDOW 2010). Ongoing monitoring of the lynx population suggests that lynx are present within the Southern Rockies, including evidence of continued reproduction (Ivan 2015). A few of the radio-collared lynx relocations obtained from all 166 lynx released in Colorado from 1999 through 2004 as part of the Colorado lynx reintroduction program occurred in the Crystal River watershed (Shenk 2005). Colorado Division of Wildlife monitoring of radio-collared lynx from February 1999 to August 2010 (Theobald and Shenk 2011) estimated that the Crystal River watershed is located outside of lynx low-use areas. Because the monitoring of radio-collared lynx has ended, it is unknown if Theobald and Shenk's (2011) use data reflect current lynx use. Theobald and Shenk (2011) explicitly stated that their "study was not intended… to predict potential or future habitat use."

Potential lynx habitat in the Crystal River watershed occurs at the highest elevations of the montane and subalpine zones, not the habitats along the valley bottom up to McClure Pass where all direct and most indirect effects of the proposed trail would occur. The only possible trail effects to lynx habitat would be minor habitat loss and displacement of lynx from illegally built social trails through lynx habitat as a result of authorized trail segments east of the Crystal River providing access into large blocks of currently inaccessible NFS lands.

6.2 USFS REGION 2 SENSITIVE SPECIES

Region Two (R2) of the USFS has designated "sensitive species," representing species declining in number or occurrence or whose habitat is declining, either of which could lead to Federal listing if action is not taken to reverse the trend, and species whose habitat or population is stable, but limited. From the updated R2 animal list (Oct. 23, 2015), a subset of sensitive species, including three insects, five fish, two amphibians, 17 birds, and nine mammals (Table 6-1), was determined to be present or potentially present on the WRNF after consideration of all sensitive species on the R2 list. This subset of species is considered below in phylogenetically ordered taxa (insects, fish, amphibians, birds, and mammals) and discussed individually where appropriate. The proposed trail would have **no impact** on any other R2 sensitive species not on the WRNF list.

Table 6-1. USFS Region 2 sensitive animal species that occur on the WRNF and the rationale for potential project effects related to the proposed Crystal River Trail.

Common name, Scientific name	**Rationale for Potential Project Effects (Habitat Affinity)**
INSECTS	
Western bumblebee, *Bombus occidentalis*	Potential habitat (Montane and subalpine meadows)
Great Basin silverspot, *Speyeria nokomis nokomis*	Potential habitat (Wetlands supporting violet populations)
Monarch butterfly, *Danaus plexippus plexippus*	No host plant (milkweed) habitat
FISH [a]	
Roundtail chub, *Gila robusta robusta*	No suitable habitat (CO River up Roaring Fork)
Mountain sucker, *Catostomus platyrhynchus*	No suitable habitat (small to medium streams below 7000'; 4 populations documented on the Rifle and Blanco Districts)
Bluehead sucker, *Catostomus discobolus*	Occupied habitat downstream (CO River up Roaring Fork)
Flannelmouth sucker, *Catostomus latipinnis*	Occupied habitat downstream (CO River up Roaring Fork)
Colorado River cutthroat trout, *Oncorhynchus clarkii pleuriticus*	Present in Avalanche Ck & Lake (Isolated, headwater streams and lakes)

Table 6-1. USFS Region 2 sensitive animal species that occur on the WRNF and the rationale for potential project effects related to the proposed Crystal River Trail.

Common name, Scientific name	Rationale for Potential Project Effects (Habitat Affinity)
AMPHIBIANS	
Boreal western toad, *Anaxyrus boreas boreas*	Present[b]. Potential dispersal and hibernacula habitat (Subalpine marshes and wet meadows; ponds, margins of streams; adjacent uplands 8,500-11,000')
Northern leopard frog, *Lithobates pipiens*	Outside Range (Permanent wetlands)
BIRDS	
Northern goshawk, *Accipiter gentilis*	Present[c] (Closed montane forests > 7,500')
Northern harrier, *Circus cyaneus*	No habitat (Grasslands, agricultural lands, marshes, & alpine)
Ferruginous hawk, *Buteo regalis*	No habitat (Plains, grasslands)
American peregrine falcon, *Falco peregrinus anatum*	Active nest present (Cliffs, habitats concentrating/ exposing prey)
Bald eagle, *Haliaeetos leucocephalus*	Present (Open water bodies, big game winter range)
White-tailed ptarmigan, *Lagopus leucurus*	No habitat (Alpine habitat and upper elevation willow stands)
Greater sage grouse, *Centrocercus urophasianus*	No habitat (Sagebrush)
Columbian sharp-tailed grouse, *Tympanuchus phasianellus columbianus*	No habitat (Sagebrush and mountain shrub)
Flammulated owl, *Otus flammeolus*	Pot. habitat (Old-growth ponderosa pine and aspen)
Boreal owl, *Aegolius funereus*	Present[d] (Mature spruce-fir & mixed conifer)
Black swift, *Cypseloides niger*	Present[e] (Waterfalls, cliffs)
Lewis' woodpecker, *Melanerpes lewis*	Present in valley bottom cottonwoods (Ponderosa pine/cottonwoods)
Olive-sided flycatcher, *Contopus cooperi*	Pot. habitat (Open, upper elev. conifer forests)
Loggerhead shrike, *Lanius ludovicianus*	No habitat (Plains, low valleys, shrublands)
Purple martin, *Progne subis*	Present[f] (Old-growth aspen)
Brewer's sparrow, *Spizella breweri*	No habitat (Sagebrush and other structurally similar shrublands)
Sage sparrow, *Amphispiza belli*	No habitat (Low elevation big sagebrush and sage/greasewood)
MAMMALS	
Pygmy shrew, *Microsorex hoyi montanus*	Pot. habitat (Variety of subalpine habitats)
Fringed myotis, *Myotis thysanodes*	No habitat (Forests/woodlands to 7,500 ft.; unknown on WRNF
Hoary bat, *Lasiurus cinereus*	No habitat (Mixed conifer and lodgepole pine forest)
Spotted bat, *Euderma maculatum*	No habitat (Cliffs, arid terrain)
Townsend's big-eared bat, *Corynorhinus townsendii townsendii*	Pot. habitat (Structures, tree cavities, mines <9,500 ft.)
American marten, *Martes americana*	Pot. habitat (Conifer forests)
River otter, *Lontra canadensis*	No habitat (Year-round open water and streamflows of ≥ 10 cfs)
Rocky Mountain bighorn sheep, *Ovis canadensis canadensis*	Present (High visibility habitat near escape terrain)

Note: Species in **bold** are potentially present. Wildlife are listed phylogenetically.
Other R2 species are not listed because they have not been found on the WRNF, they have no affinities to project area habitats, the project area is outside of the species' range or elevational distribution. Potential pre-field survey occurrence on the project area, potential for project effects, and habitat affinity is summarized for each species.

[a] With the exception of Colorado River cutthroat trout, fish occurrence in the analysis area is poorly documented in available data sources.

[b] Documented in the Middle Thompson Creek PCA (Spackman et al. 1999), although the entire Crystal River valley is outside of overall boreal toad range mapped by CPW.

[c] Active nest documented in the Middle Thompson Creek PCA (Spackman et al. 1999).

[d] Documented in the Middle Thompson Creek PCA (Spackman et al. 1999).

[e] Documented in the Avalanche Creek PCA (Spackman et al. 1999).

f Documented in the Crystal River Valley by Crystal River Caucus (2007). Documented in the McClure Pass PCA, but possibly on the west side of the pass, outside the current analysis area (Spackman et al. 1999).

Table 6-1. USFS Region 2 sensitive animal species that occur on the WRNF and the rationale for potential project effects related to the proposed Crystal River Trail.	
Common name, Scientific name	**Rationale for Potential Project Effects (Habitat Affinity)**
Source: Forest Service Manual, Rocky Mountain Region, Denver, CO, Chapter 2670 – Threatened, Endangered and Sensitive Plants and Animals, Supplement No: 2600-2015-1, Effective Date: Oct. 23, 2015 (J. Austin, USFS, pers. comm., Nov. 17, 2016).	

Some of the R2 species contained in Table 6-1 require specific seasonal surveys to detect. Where those surveys have not been conducted, a species was considered to present if suitable habitat is present, following USFS policy. In summary regarding R2 animals, 17 species are known or are potentially present within the Crystal River Trail analysis area. As a worst case scenario, the proposed trail "may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing"[11] for the following species: western bumblebee (*Bombus occidentalis),* Great Basin silverspot (*Speyeria nokomis nokomis),* Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), boreal western toad (*Anaxyrus boreas boreas*), northern goshawk (*Accipiter gentilis*), American peregrine falcon (*Falco peregrinus anatum*), bald eagle (*Haliaeetos leucocephalus*), flammulated owl (*Otus flammeolus*), boreal owl (*Aegolius funereus*), black swift (*Cypseloides niger*), Lewis' woodpecker (*Melanerpes lewis*), olive-sided flycatcher (*Contopus cooperi*), purple martin (*Progne subis*), pygmy shrew (*Microsorex hoyi montanus*), Townsend's big-eared bat (*Corynorhinus townsendii townsendii*), American marten (*Martes americana*), and Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*). With respect to the determination for bighorn sheep, while some trail alignments could have negative direct and indirect effects that could further reduce the size of the local population, the population would likely persist or could be reintroduced if sufficiently effective habitat remains in the event recreational trails are developed in areas with critical sheep habitat. Furthermore, the project's potential impact on sheep is considered across the entire planning area, the WRNF, where other sheep populations occur and would be unaffected by the project. Excluding those species above, the proposed trail would have "no impact"[12] on any other R2 species.

6.3 COLORADO PARKS AND WILDLIFE-MAPPED SPECIES

Eight[13] wildlife species mapped by CPW have seasonal ranges overlapping proposed Crystal River Trail corridor sections B and C (Section 10.3). Wildlife activity area definitions and seasonal use dates (Section 10.2) were obtained from the CPW website and are applicable generally statewide. Some seasonal use dates are defined more accurately for the local Data Analysis Units (i.e., the local management areas) by the local DWM (J. Groves, pers. comm., Mar. 27, 2017) and the Terrestrial Biologist, per CPW direction. Other use periods are provided based on anecdotal observations by identified knowledgeable parties.

Species are listed in declining order of their susceptibility to significant potential trail effects along the bottom of the Crystal River Valley. Bighorn sheep and elk are the species of particular concern. The

[11] This is the required wording for impacts to U.S. Forest Service sensitive species where effects are expected to be insignificant (unmeasurable) or discountable (extremely unlikely; Forest Service Manual R-2 Supplement 2672.42) at the Forest level.

[12] This is the required wording for impacts to U.S. Forest Service sensitive species where no effect is expected at the Forest level (Forest Service Manual R-2 Supplement 2672.42).

[13] Other wildlife species (e.g., mountain goat and lynx) mapped by CPW have seasonal ranges overlapping portions of the Crystal River watershed, but they are not focal species of concern on this project.

order of the remaining species is somewhat arbitrary. Other habitats of these CPW-mapped species may also be affected outside of the Crystal River Valley bottom. Habitats and potential trail segments not in conflict with potential trail use are not mentioned.

In the descriptions of the wildlife seasonal activity areas, metrics (e.g., whether important habitats would be bisected by potential trails or whether trails would approach within one-quarter mile of certain habitats) are provided that have implications regarding whether certain trail segments would be subject to seasonal construction and closure restrictions to protect certain wildlife activity areas if the county Land Use Code (7-20-70: Wildlife Habitat Areas) was applied.

6.3.1 Bighorn Sheep

6.3.1.1 Seasonal Sheep Activity Areas

Important bighorn sheep seasonal ranges throughout the proposed Crystal River trail corridor are shown in Figures 10.2-1 to 10.2-3. Other less important (to this analysis) seasonal ranges, including overall range, summer range, and summer concentration area, are more widespread in the analysis area, but are not shown on maps to more clearly illustrate important habitats.

Sheep winter range, used from December 1 to April 30, is continuous east of the Crystal River from Potato Bill Creek to East Creek, with another polygon to the south in Hawk and Big Kline Creeks. Sheep winter range is bisected by 0.62-miles of Highway 133 in The Narrows, north of Filoha Meadows and borders sheep winter range in Hayes Creek Canyon. Portions of two of the three potential trail segments (Red Wind Point [RWP] and Janeway and Filoha Meadows [J&F]) east of the river would bisect 3.0 miles of currently isolated[14] sheep winter range. The potential Crystal River Open Space (CROS) trail segment would approach (within one-quarter mile), but not bisect, sheep winter range. The potential Hayes Creek Canyon bypass and old McClure Pass Road switchback trail segments are outside of sheep winter range.

Sheep winter concentration areas are used from December 1 to April 30. These winter range subsets, support twice the animal density of overall winter range and also a critical wildlife habitat in Pitkin County, occur in eight polygons, all east of the river, in the analysis area. Locations include Potato Bill Creek, Red Wind Point, at the mouth of Avalanche Creek (north side), the south-facing slopes of Elephant Mountain north of Filoha Meadows, snow-shedding terrain east of Filoha Meadows, an area above Wild Rose Subdivision, and polygons on the south-facing slopes above East and Hawk Creeks. The Highway 133 corridor does not bisect any of this critical sheep habitat. Portions of the potential RWP trail segment east of the river would bisect 0.1 miles of currently isolated sheep winter concentration areas. Large acreages of critical, sheep, winter concentration areas occur within one-quarter mile of the RWP and J&F trail segments. The CROS trail segment east of the river would occur beyond one-quarter mile of the Potato Bill Creek sheep winter concentration area. A new north bridge that would likely be associated with the RWP trail segment would occur within one-quarter mile of the RWP, sheep, winter concentration area.

[14] Wildlife habitats bisected by the three potential trail segments (CROS, RWP, and J&F]) east of the river are largely **isolated** from human disturbance during winter by the physical barrier imposed by the Crystal River, the width of the buffer of intervening habitat between human use areas along the Highway 133 corridor and habitats east of the river, and the largely effective seasonal closures. That isolation minimizes human disturbance and increases **habitat effectiveness**, the ability of animals to utilize habitats present without impairment from anthropogenic influences.

Sheep severe winter ranges are used from December 1 to April 30. These areas are composed of south-facing slopes used when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of 10. They are critical wildlife habitats in Pitkin County and occur in six polygons, all east of the river, in the analysis area. Locations include Potato Bill Creek, Red Wind Point, Avalanche Creek, Elephant Mountain, and polygons above East and Hawk Creeks. None of the potential trail segments would bisect this critical sheep habitat. Portions of the potential RWP and J&F trail segments east of the river would occur within one-quarter mile of three, sheep, severe winter range polygons. The CROS trail segment east of the river would occur beyond one-quarter mile of the Potato Bill Creek sheep severe winter range. A new north bridge that would likely be associated with the RWP trail segment would occur within one-quarter mile of the RWP, sheep, severe winter range polygon.

Sheep production (lambing) areas, used from May 1 to June 30, occur in six polygons, all east of the river, in the analysis area. Locations include Potato Bill Creek, Nettle Creek, the west-northwest toe slope of Mt. Sopris, the north side of Avalanche Creek, a large polygon extending from west of Filoha Meadows to East Creek, and a polygon in Hawk Creek. No potential trail segment would bisect any sheep lambing area. The three potential trail segments east of the river would extend within one-quarter mile of portions of the Nettle Creek, Red Wind Point, Avalanche Creek, and Filoha Meadows lambing areas.

A **sheep migration corridor** occurs in The Narrows on the west side of Elephant Mountain. Much of the sheep movements through this corridor follow the historic railroad grade and a closely parallel grade. Overall sheep use of this local corridor occurs from November 15 to May 1, with ram use heightened during the rut from November 15 to December 31 (J. Groves, CPW, pers. comm., Mar. 27, 2017). Local CDOW/CPW DWMs have documented bighorn sheep traveling along the railroad corridor between Penny Hot Springs and Lower Avalanche Creek from as early as August to as late as June (Tucker 2003). The CDOW/CPW considers this area crucial for bighorns due to the adequate escape cover provided by the rockslide and cliffs to the east, the mineral rich grounds provided by the natural hot springs, and the effective buffer of the Crystal River from vehicle and other human caused disturbances. General movement patterns of sheep are also shown in Figures 10.2-1 to 10.2-3. Isolated by the river and buffered by distance and intervening terrain, sheep are largely habituated to traffic along the Highway 133 corridor such that it does not affect sheep use of this corridor. The potential J&F trail segment east of the river would develop and occupy one of the two parallel railroad grades that are the centerlines of this sheep migration corridor.

A **sheep mineral lick** is associated with Penny Hot Springs and extends approximately 1,500 feet upstream. This area provides minerals important to bighorn sheep for meeting basic nutritional needs. Lick use typically starts in mid-June, peaks the first week of July, then tapers off asymptotically, depending upon how much socialization is involved in lick use. Local use of the licks has been observed as late as mid-August (J. Groves, CPW, pers. comm., Mar. 27, 2017). Radio-collar data have shown extended movements over several days from high summer range, down to the mineral licks, and back to the high summer range. There is likely some displacement of sheep by humans in the immediate vicinity of Penny Hot Springs. There is some level of sheep habituation to this human activity because humans, predictably, don't cross the river. Most of the mineral licks upstream of Penny Hot Springs are not affected by human presence and are available to the sheep 24/7. None of the potential trail segments would directly bisect any sheep mineral lick, however sheep would have to cross the potential J&F trail segment to access any of the Penny Hot Springs' licks.

6.3.1.2 Disease in the Local Sheep Herd

This sheep herd is infected with pasteurellosis, a bacteria acquired from domestic sheep on bighorn winter range in the Marble area. It has caused pneumonia that has adversely this herd's lamb recruitment and survival and, to a lesser extent, reduced adult survival. Adults are carriers and pass it on to cohorts and offspring. Lamb mortality (at ± 95% by 6-8 weeks after birth) over the last 20 years has led to an approximate 80% decline in this herd (using estimate midpoints; from a peak of approx. 225-250 sheep in the mid- to late 1990's to approx. 45-50 sheep at present; J. Groves, CPW, DWM, pers. comm., Mar. 15, 2017). In 2002, the CDOW documented one lamb out of 28 sheep in the Avalanche Creek drainage and one lamb out of 26 sheep near Penny Hot Springs (Tucker 2003). The belief at that time was that while lamb production was adequate for positive population growth, there has been high lamb mortality in the first year (Colorado Wildlife Science 2008). Lamb mortality has remained high and the population decline has continued (J. Groves, CPW, pers. comm., Mar. 15, 2017).

Lungworm is also affecting the herd. The CDOW/ CPW have been and are treating the animals, but this disease continues to negatively affect herd growth and persistence. See Colorado Wildlife Science (2008, p.8) for a summary of lungworm/ bighorn life history. Both diseases increase the sheep's susceptibility to external stressors by weakening them and reducing their ability to forage and avoid predators. Sheep displacement from trail corridors and disturbance by trail users would exacerbate the disease effects and further impact this herd.

6.3.2 Elk

Important elk seasonal ranges throughout the proposed Crystal River trail corridor are shown in Figures 10.2-4 to 10.2-6. Other less important (to this analysis) seasonal ranges, including overall range, summer range, resident population area, and summer concentration area, are more widespread in the analysis area, but are not shown on maps to maximize the clarity of important habitats.

Elk winter range (Dec. 1 to Apr. 1) is continuous along the entire Crystal River valley bottom and toe slopes from above Marble to Carbondale. With the exception of a 1.3-mile section of highway below the McClure Pass summit, Highway 133 bisects 12.9 miles of elk winter range along the length of Crystal River trail Segments B and C. The entire lengths of the three potential trail segments (CROS, RWP, and J&F) east of the river would bisect 6.8 miles of currently isolated and highly effective elk winter range. The entire (1.4 mi.), potential Hayes Creek/ Bear Creek trail segment and the bottom (1.5 mi.) of the old McClure Pass Road switchback trail segment would bisect elk winter range. Winter range north of the old McClure Pass Road switchbacks extends further uphill (west) than what is currently designated on CPW mapping. It is also more effective habitat than that located further south along Highway 133, including the ascent to the pass, because of better snow shedding characteristics and a more valuable (as forage vs. mixed conifer and aspen) mountain shrub-dominated vegetation type.

Elk winter concentration areas, a critical wildlife habitat in Pitkin County, occur along both sides of the Crystal River valley bottom; four polygons are relevant to this analysis. Locations include the west and southwest toe slopes of Mt. Sopris from Potato Bill Creek to and up Avalanche Creek, Filoha Meadows, the area east of Redstone to Hawk Creek, and a large polygon approaching the highway near Placita that extends up valley to near Island Lake. The Highway 133 corridor bisects 0.4 miles of winter concentration area in the vicinity of Hawk Creek and Filoha Meadows, respectively. The potential J&F trail segment east of the river would bisect 2.0 miles of critical, highly effective, elk winter concentration area in the Janeway, Avalanche Creek, and Filoha Meadows areas. The potential CROS and RWP trail

segments would occur beyond one-quarter mile of any elk winter concentration area. A new north bridge that would be associated with the J&F trail segment would likely occur within one-quarter mile of the Janeway, elk, winter concentration area.

Elk severe winter range, a critical wildlife habitat in Pitkin County, occurs along both sides of the Crystal River valley bottom; three polygons are relevant to this analysis. Locations include Avalanche Creek, the area east of Redstone to Hawk Creek, and a large polygon approaching the highway near Placita that extends up valley to near Island Lake. The Highway 133 corridor would bisect 0.1 miles of this critical elk habitat in the vicinity of Hawk Creek. The potential J&F trail segment east of the river would bisect 0.6 miles of critical, highly effective, elk, severe winter range in the mouth of Avalanche Creek.

Elk production (calving) areas, used May 15 to June 21, as currently protected in the Pitkin County Code, occur above the valley bottom mostly towards the southern end of the analysis area. Based on the Vail elk study (Phillips [1998] and Phillips and Alldredge [2000]), May 1 to July 1 would be a more biologically conservative closure period, allowing cows to select optimal calving sites, accommodating early and late calves, and including initial elk rearing when calves develop physically to where they can travel with their cow. Of note is that no calving polygon is shown for Filoha Meadows. The County's wildlife biologist addressed this issue (Colorado Wildlife Science 2008) as follows:

> Dr. Bernarr Johnson, who has lived across the river from FMNP for over 20 years, has reported observing very young spotted calves on the property in mid-June (Johnson 2003). In 2003 and 2004, OST staff confirmed that a few elk cows probably dropped their calves in the riparian forest on the southern half of the property. Three very young spotted calves were observed on 10 June 2003 and two were observed on 8 June 2004. Although the CDOW species distribution maps do not indicate this area as elk calving habitat (or "production area"), these observations combined with Dr. Johnson's many sightings over the years probably warrant this designation.

The Highway 133 corridor does not bisect any CPW-designated elk calving area nor would any of the potential trail segments east of the river. The Highway 133 corridor and portions of Redstone Boulevard come within one-quarter mile of elk calving polygons, but the calving areas are topographically, visually, and otherwise buffered from potential trail use along the existing roadway. No other potential trail segments would occur within one-quarter mile of elk calving areas.

However, one calving polygon warrants further consideration. There is an elk calving polygon on the west side of the Crystal River that starts 0.37 miles above the potential Hayes Creek/ Bear Creek trail segment. Above the potential trail segment was an historic homestead on a bench with a road that switchbacked up the mountain into the elk calving area. The road has apparently been decommissioned by the USFS, but there is a low level of existing hiker use associated with it. The potential Hayes Creek/ Bear Creek trail segment could facilitate unintended access to that road, facilitate social trail development, and negatively affect elk calving values in and beyond that polygon. Hiking and other recreational activities in or near elk calving areas can have a significant impact on reproductive success. Phillips (1998) and Phillips and Alldredge (2000) studied reproductive success of elk following disturbance by humans during calving seasons in central Colorado. They reported that human disturbance during the calving season resulted in a significant drop in reproductive success below that of an undisturbed control group, but it recovered to control levels in subsequent years when human disturbance was experimentally removed (Shively et al. 2005).

There is a dimensionless[15] **elk migration corridor** across Highway 133 approximately 0.33 miles north of where the old McClure Pass switchback meets the highway and approximately 0.26 miles south of where the south end of the Hayes Creek/ Bear Creek trail segment meets the highway. Local use of this corridor has been defined as October 15 to November 30 and April 15 to May 30, all dates inclusive. Two **elk highway crossings**[16] occur in the analysis area, the first overlapping the above elk migration corridor and the second across from Filoha Meadows and the southern end of the J&F trail segment.

6.3.3 Mule Deer

Important mule deer seasonal ranges throughout the proposed Crystal River trail corridor are shown in Figures 10.2-7 to 10.2-9. Other less important (to this analysis) seasonal ranges, including overall range and summer range, are more widespread in the analysis area, but are not shown on maps to maximize the clarity of important habitats.

Mule deer winter range extends up the Crystal River valley as far as Perham Creek on the west and Nettle Creek on the east. Most of the trail corridor analysis area is above deer winter range. Deer winter use occurs from December 1 to April 30, dates inclusive, after animals have migrated down valley from upper elevation summer ranges. Highway 133 bisects deer winter range from the south end of the existing bike trail, south to past Nettle Creek. The entire CROS potential trail segment and the northern 0.4 miles of the potential RWP trail segment east of the river would bisect currently isolated deer winter range.

No other important seasonal deer range in the analysis area would be affected by the highway or other tentatively identified off-highway trail segments.

6.3.4 Bald Eagle

Two, overlapping polygons of seasonal bald eagle (*Haliaeetus leucocephalus*) habitat, **winter range** (Nov. 15 – Apr. 1) and **winter foraging habitat** (Nov. 15 – Mar. 15), occur in the analysis area (Figs. 10.2-10 to 10.2-12). The winter habitat is widely distributed across the valley bottom and side slopes, south up to Perham Creek, then closely associated with the river further south. However, winter eagle foraging south of Perham Creek also extends to the periphery of big game winter range polygons where eagles forage occasionally away from the river on winter-killed ungulates. Highway 133 bisects bald eagle winter range through almost the entire analysis area up to south of where the old McClure Pass switchbacks meet the highway. With the exception of where the J&F trail segment would cross over the ridge saddle near the mouth of Avalanche Creek, the entire lengths of the three potential trail segments (CROS, RWP; and J&F) east of the river would bisect currently isolated bald eagle winter range. The entire, potential Hayes Creek/ Bear Creek trail segment and the bottom of the old McClure Pass Road switchback trail segment would bisect winter bald eagle habitats.

[15] Mapped migration corridors typically have a width and length along the associated highway segment. This corridor is represented simply by an arrow within the elk highway crossing. It is a reasonable assumption that the migration corridor's dimension is consistent with that of the highway crossing.

[16] Defined in Section 10.2.2.

6.3.5 Peregrine Falcon

An **active peregrine falcon** (*Falco peregrinus anatum*) **nesting area** and three **potential nesting areas** are located in the analysis area (Figs. 10.2-13 to 10.2-15). The active eyrie[17] is located in the vicinity of Hayes and Hawk Creeks. According to Jerry Craig, the former CDOW Raptor Biologist (ret.; pers. comm., ca. 2007), eggs are laid as early as April 15, young hatch mid- to late May, and fledge in mid- to late June. So, the most important nesting period would be April 15-June 30. This does not include courtship or post-fledging use of the area.

The following peregrine life history information is not present in the Crystal River wildlife documents and is needed for this analysis. Viable peregrine nesting sites possess two components: (1) adequate nesting habitat, and (2) extensive hunting habitat with an adequate prey base to support the adults and their offspring (Craig 1978). Nesting sites are located on precipitous cliffs ranging in height from 40 to 2,100 feet, averaging 200 to 400 feet tall. Several ledges, potholes, or small caves must be present in the cliff face to function as a suitable nest site. A breeding pair will frequently alternate their nesting activities to different ledges on a cliff face between years, and they will often relocate to adjacent cliff faces. As a result, protective measures must address an entire cliff complex (and potential nesting areas) rather than an individual cliff.

Nesting peregrines will not tolerate excessive human encroachment or prolonged disturbance in the vicinity of the nesting cliff. Any activity or development above the nesting cliff will likely cause abandonment. Breeding peregrines become extremely agitated and may abandon the nest site if disturbance occurs during courtship, prior to the initiation of egg laying. One explanation regarding why some sites are occupied in spite of excessive human activity in the vicinity of the nesting cliff is that the falcons occupied the site early in the nesting season prior to spring increases in human activity and had eggs or young when the disturbance occurred. Once birds have eggs or young, they have a strong fidelity to their invested resources. Such bird were, therefore, attached to the site and would not abandon it at that time.

In Colorado, peregrines usually return to nesting cliffs in late February or early March and initiate courtship activities, which continue to mid- or late April when eggs are laid. The young hatch from mid- to late May and fledge (i.e., leave the eyrie) in mid- to late June. The young and adults remain in the vicinity of the nesting cliff up to several months after fledging.

Extensive hunting habitat is a second key component of a viable peregrine nest site. Peregrines will frequently travel at least 10 miles from their eyrie to procure prey and they have been documented hunting up to 30 miles away from nest sites (G. Craig, CDOW, pers. comm.). It is, therefore, important to maintain the integrity of important hunting areas within at least 10 miles of the nesting cliff. All habitats within the 10-mile radius need not be considered essential habitat, since only those areas that attract or support peregrine prey need be protected. The primary prey captured by nesting Colorado peregrines are small to moderately-sized birds, such as blackbirds, doves, robins, flickers, jays, nutcrackers, meadowlarks, and pigeons, but prey as large as waterfowl are also taken. Any habitat that supports or concentrates birds should be considered essential to locally nesting peregrines.

Key hunting areas fall into two categories: (1) those habitats that concentrate or support important prey species, and (2) those habitats that expose prey and make them vulnerable to peregrine attack. Peregrines capture their prey through precipitous dives from considerable height above their quarry. Peregrines must, therefore, frequent habitats permitting this type of pursuit. Peregrines do not hunt

[17] The shape of the CPW nesting polygon suggests that at least three active nest sites have occurred on the nest cliff.

below the forest canopy, but capture birds flying above forests or across open expanses. Larger prey are raked (with talons) or knocked out of the air and peregrines need open areas on the ground to recover them. Nesting cliffs, are generally situated at considerable heights above the surrounding terrain, so peregrines have a broad panorama from favorite hunting perches near the cliff top.

Peregrine falcons are an R2 sensitive species on the WRNF. The following, applicable, Forest Plan, Forest-wide, Wildlife Standards 8 and 9 specify the following:

> 8. Discourage land use practices and development that adversely alter the character of peregrine falcon hunting habitat or prey base within ten miles of the nest site and the immediate habitats within one mile of the nesting cliff.
>
> 9. Human activities will be restricted within one-half mile of the occupied peregrine falcon areas between March 15 and July 31 for nest sites, or July 1 to September 15 for hack sites.

One and 1.8 miles of Highway 133 occur within 0.5 and 1.0 miles of the active peregrine nest site, respectively.[18] Approximately 0.4 miles of the potential Hayes Creek/ Bear Creek trail segment occurs within one mile of the active eyrie. The habitat bisected by that trail does not support a concentrated prey base, but does provide settings where prey expose themselves to peregrine attack. Standard 8 in the WRNF Forest Plan would discourage development of that trail.

With the exception of the northern one-half (approx.) of the potential CROS trail segment and the adjacent highway trail alignment, the entire lengths of the highway and all off-highway trail alignments would occur within 10 miles of the active eyrie and, therefore, represent potential foraging habitat. All three potential peregrine nesting areas would also have foraging ranges that overlap most of the river valley's riparian corridor, wetlands, and meadows that support the greatest potential prey densities and expose birds to predation. Mapping of potential peregrine nesting areas in the Crystal River valley has undoubtedly changed over the years. In the wildlife report for Filoha Meadows, Colorado Wildlife Science (2008) indicated:

> There is an historic peregrine falcon nesting area on cliffs within a ½ mile of Filoha Meadows Nature Preserve... There have been active peregrine eyries (nest sites) on nearby cliffs in at least 4 of the last 7 seasons.

The current edge of the potential peregrine nesting area adjacent to Filoha Meadows is approximately 0.5 miles away from the closest approach of that trail segment. Filoha Meadows meets all of criteria to be considered high quality peregrine hunting habitat (Colorado Wildlife Science 2008).

As for the other wildlife species considered in this analysis, potential trail impacts to peregrines are not so much the habitat lost to trail development as the considerably greater area of adjacent habitat disturbed by trail users where some peregrine prey (i.e., birds) are displaced and could occur in reduced abundance.

6.3.6 Black Bear

Important black bear seasonal ranges throughout the proposed Crystal River trail corridor are shown in Figures 10.2-16 to 10.2-18. Other less important (to this analysis) seasonal ranges, including overall

[18] For the purposes of this analysis, the distances are measured from a generalized central point in CPW's polygon, which was generated from three alternate nest sites on the nest cliff.

range and summer concentration area, are more widespread in the analysis area, but are not shown on maps to maximize the clarity of important habitats.

Fall concentration areas include montane shrublands and other habitats providing higher forage quality and abundance during the fall (Aug. 15 until Sept. 30) hyperphagic period when bears maximize pre-winter weight gain in preparation for winter. Virtually the entire Highway 133 corridor bisects black bear fall concentration area, from north of Nettle Creek nearly to the summit of McClure Pass. The entire potential RWP, J&F, and Hayes Creek/ Bear Creek trail segments would bisect currently isolated black bear fall concentration areas.

Black bear human conflict areas are associated with some local subdivisions, usually where inappropriate garbage management has led to two or more confirmed black bear complaints per season resulting in CPW investigation, damage to persons or property (cabins, tents, vehicles, etc.), and/or the removal of the problem bear(s). The Highway 133 corridor would not bisect any black bear human conflict area. A short section of the potential CROS trail segment bisecting a corner of the subdivision at the mouth of Potato Bill Creek and that portion of the potential trail following the road through Redstone and outlying subdivisions would bisect black bear human conflict areas. This habitat is not one of particular concern regarding potential trail siting.

6.3.7 Moose

Important moose (*Alces alces*) seasonal ranges throughout the proposed Crystal River trail corridor are shown in Figures 10.2-19 to 10.2-21. Other less important (to this analysis) seasonal ranges, including overall range and summer range, are more widespread in the analysis area, but are not shown on maps to maximize the clarity of important habitats.

Moose winter range use extends from November 15 to April 1. In the analysis area, it occurs above the west side of the valley to just south of Redstone, after which it occurs along the valley bottom and side slopes is bisected by most of the Highway 133 corridor, the potential Hayes Creek/ Bear Creek trail segment, and the old McClure Pass switchbacks.

The edge of a large **moose concentration area**, where densities are 200% higher than the surrounding area, overlaps the top of Highway 133 at McClure Pass and the top of the old McClure Pass switchbacks.

6.3.8 Wild Turkey

Important wild turkey (*Meleagris gallopavo*) seasonal ranges throughout the proposed Crystal River trail corridor are shown in Figures 10.2-22 to 10.2-24. Other less important (to this analysis) seasonal ranges, including overall range, are more widespread in the analysis area, but are not shown on maps to maximize the clarity of important habitats.

Turkey winter range is where 90% of the individuals are located from November 1 to April 1 during the average five winters out of 10. Two areas of turkey winter range are mapped in the analysis area, on the southwest toe slopes of Mt. Sopris and at the mouth of Coal Creek west of Redstone. The Highway 133 corridor would not bisect any turkey winter range. A portion of the potential J&F trail segment would bisect turkey winter range in the mouth of Avalanche Creek.

6.3.9 Quantification of Impacts to Colorado Parks and Wildlife-Mapped Species

Table 6-2 quantifies the distances of potential trail segments bisecting important wildlife habitats in the Crystal River analysis area. Table 6-2 indicates that there would be potential wildlife conflicts with all potential trail segments. The trail segment with the least negative effects on wildlife would be Redstone Boulevard, because there would be no habitat loss and virtually no reduced effectiveness of adjacent habitat because of existing road condition and use.[19] The trail segment with the greatest negative effects on wildlife would be J&F, whose 5.5 miles would bisect a total of 32.1 miles of important, highly effective wildlife habitats. The longest potential segment, the Highway 133 corridor, has the greatest intersect mileage, including that of some critical habitats, but those apparent conflicts are misleading. Since its inception in the 1970's, wildlife seasonal range mapping has been conducted at a relatively coarse 1:50,000 scale. Highways per se have little to no value to the specific species considered herein and are generally avoided by those wildlife. If it were meaningful and practical to exclude highway ROWs from mapping they would have been. Therefore, with the possible exception of highway crossing for some species, the intercepts of Highway 133 with various wildlife ranges is a specious artifact of mapping practicalities.

Nevertheless, there would be direct habitat losses associated with trail segments along Highway 133. Some of those habitats are highly effective for some species (e.g., Lewis' woodpecker nesting). However, all of the affected habitat would be within the highway's existing zone of influence that most wildlife, including those species of greatest concern (elk and sheep), currently avoid. Therefore, the negative effects of the highway alignment trail segments are largely discountable for most wildlife species, including all CPW-mapped species, with the exception of the elk highway crossings where road-mortality has occurred. Furthermore, even though the highway ROW may locally support some habitats with high functional values to some species, there would be less year-round impacts to the wildlife community if a trail was located within the highway's disturbance corridor rather than introducing new trail use into currently buffered, isolated, and highly effective habitats. This is particularly true for the J&F, RWP, and CROS trail segments (in that order) east of the Crystal River. Those three trail segments would total 6.8 miles and would bisect 39.2 miles of important wildlife habitats, including 9.8 miles of elk and bighorn sheep winter range and 2.7 miles of critical elk and bighorn sheep winter concentration area and severe winter range. This is explained in greater detail in Section 8.1, below.

Table 6-2. Distances (mi.) of potential trail segments bisecting important wildlife habitats in the Crystal River analysis area. Critical habitats are indicated with a symbol (*).

Wildlife Species Activity Area [b]	**Potential Trail Segment** [a]					
	Hwy. 133	**CROS**	**RWP**	**J&F**	**HC/BC**	**Old MP**
TRAIL SEGMENT MILES	12.9	0.3	1.0	5.5	1.4	2.8
Bighorn Sheep						
Winter Range	1.0		0.5	2.5	0.0	
WCA*			0.1*			
SWR*						
Production						

[19] For that reason, the Redstone trail segment is not included in Table 6-2.

Table 6-2. Distances (mi.) of potential trail segments bisecting important wildlife habitats in the Crystal River analysis area. Critical habitats are indicated with a symbol (*).

Wildlife Species Activity Area [b]	**Potential Trail Segment** [a]					
	Hwy. 133	**CROS**	**RWP**	**J&F**	**HC/BC**	**Old MP**
Migration Corridor				0.5		
Mineral Lick	0.0					
Sum Sheep	**1**		**0.6**	**3**	**0**	**0**
Elk						
Winter Range	12.9	0.3	1.0	5.5	1.4	1.5
WCA*	0.4*			2.0*		
SWR*	0.1*			0.6*		
Production						
Migration Corridor	0.0					
Highway Crossing	1.7					0.1
Sum Elk	**15.1**	**0.3**	**1**	**8.1**	**1.4**	**1.6**
Mule Deer						
Winter Range	1.7	0.3	0.3			
Bald Eagle						
Winter Range & WFH	12.9	0.3	1.0	4.6	1.4	0.6
Peregrine Falcon [c]						
Active nesting area 0.5 mi.	1.0					
Active nesting area 1.0 mi.	1.8				0.4	
Active nesting area 10 mi.	12.1		1.0	5.5	1.4	2.8
Active nesting area CPW	1.5				0.2	
Potential nesting area	0.4					
Black Bear						
Fall Concentration Area	11.8		1.0	5.4	1.4	2.2
Human Conflict Area	2.4					
Moose						
Winter Range	**2.2**				1.4	2.6
Concentration Area						1.1
Wild Turkey						
Winter Range				0.9		
TOTAL ALL SPECIES	**77.2**	**1.2**	**5.9**	**32.1**	**9.0**	**11.5**
TOTAL SHEEP AND ELK	16.1	0.3	1.6	11.1	1.4	1.6
COUNT [d]	**18**	**4**	**8**	**10**	**9**	**8**

[a] Potential trail segments: Highway 133, Crystal River Open Space (CROS), Red Wind Point (RWP); Janeway and Filoha Meadows (J&F), Hayes Creek / Bear Creek (HC/BC), and old McClure Pass Road (Old MP) switchbacks. The Redstone trail segment is not included because trail use would be located entirely along the existing road and would have negligible wildlife effects. Note: the potential alternative trail segment following the railroad grade around the ridge south of Janeway was not included in the table's

Table 6-2. Distances (mi.) of potential trail segments bisecting important wildlife habitats in the Crystal River analysis area. Critical habitats are indicated with a symbol (*).

Wildlife Species	**Potential Trail Segment** [a]					
Activity Area [b]	**Hwy. 133**	**CROS**	**RWP**	**J&F**	**HC/BC**	**Old MP**

quantification to avoid double counting intercepts.

[b] Wildlife activity area abbreviations: Severe winter range (SWR), winter concentration area (WCA), and winter foraging habitat (WFH, for bald eagles).

[c] Following WRNF, Forest Plan, Forest-wide, Wildlife Standard 8, the most meaningful peregrine consideration for this analysis is if potential trail development and use would alter the character of peregrine falcon hunting habitat or prey base within ten miles of the nest site and the immediate habitats within one mile of the nesting cliff.

[d] Count = Number of wildlife activity areas (not the number of polygons) bisected by the trail segment.

Data Sources: CDOT, CPW, Pitkin County.

Quantification by A. Gallensky, Rocky Mountain Wild.

6.4 HABITAT CONDITIONS AND OTHER WILDLIFE GROUPS

Detailed, multi-year wildlife investigations (e.g., Colorado Wildlife Science 2008) and more extensive wildlife and ecological characterizations (e.g., Crystal River Caucus 2007) of the Crystal River valley indicated that the area supports relatively high habitat diversity and virtually all native wildlife species are still present on the valley. This occurs because the habitat is mostly intact, occurs in large blocks, and is connected to extensive surrounding public lands, much of which on both sides of the valley are difficult to access. The diverse plant communities supporting diverse wildlife populations are due in part to the valley's broad (6,518 ft.) topographic gradient (from 6,447 ft. at the north end of the CROS parcel to the summit of Mt. Sopris [12,965 ft.]) containing four (foothills to alpine) life zones, and steep perpendicular side canyons. Habitats historically disturbed by mining, logging, and other disturbances have largely recovered and provide productive wildlife values, if not native vegetation types. Residential developments have converted habitats and their associated activities have displaced wildlife from surrounding habitats. These residences, either clustered in subdivisions or dispersed, are generally confined to the valley bottom with large blocks of high quality intervening habitats (on Open Space tracts and NFS lands). Highway 133 activity is a chronic predictable disturbance with reduced habitat effectiveness flanking its length. However, with the exception of road-kills, wildlife have habituated to it to the extent they are going to.

Unfortunately, other than CPW's wildlife mapping of a relatively low number of wildlife species of greater concern, there is no meaningful systematic mapping of other species, wildlife groups, high wildlife diversity areas, or high value habitats to display. The closest available information was the Crystal River Caucus's (2007) individual and composite rankings of plant habitat, species' imperilment, wildlife activity, and stream/riparian for their six, three-mile-long subsets of the Crystal River valley, shown in Table 5-3, above.

Many of the open space parcels along the Crystal River were acquired by Pitkin County specifically for their high wildlife diversity and unique ecological communities, as well as for the critical habitats of a few wildlife species. Thus, the locations and distribution of Open Space parcels are indicators of higher wildlife values.

Graphic consideration of other important species (e.g., lynx, R2 wildlife and plants), wildlife groups (e.g., breeding birds, cavity nesters, and raptor nests), and habitats (e.g., wetlands, riparian, hot springs, and mines) may be considered in the more detailed and site-specific NEPA analyses. Consideration of most of these are addressed in Section 7.0, Potential Trail Effects on Wildlife and Habitats, below.

Lastly, those individual species mapped by CPW have affinities to a wide variety, and the majority, of habitats present in the valley. If the extensive habitats required to avoid and preserve sheep, elk, peregrine falcon, riparian, and other unique habitat values, can be considered and protected during trail planning, then the habitat values of virtually all other species present in the valley are also likely to be protected.

6.5 OTHER NOTEWORTHY RESOURCE ISSUES

6.5.1 Isolation of Habitats East of the Crystal River

In the analysis area, Highway 133 occurs entirely on the west side of the Crystal River. Habitats on the Open Space parcels east of the river, and those more extensive habitats on NFS lands to the east, are currently difficult for the public to access due to the river, intervening private property, and limited public access portals (e.g., Avalanche Creek Road). The river provides an effective barrier to public access and buffers human disturbances west of the river from the high value habitats to the east. Although some residents east of the river may violate seasonal wildlife closures by hiking sections of the abandoned railroad grade, most residents comply with the closures and most sections of the railroad grade and adjacent habitats are highly effective for wildlife. The critical nature of seasonal sheep and elk habitats east of the river is not only due to the habitats present, but also because of the lack of human disturbance that allows the habitats to be used effectively.

6.5.2 Contiguous Isolated Drainages

A lack of easy public access to public and private lands east of the Crystal River has effectively protected large tracts of habitat from human disturbance that would otherwise have occurred. Remarkably, three contiguous drainages, Thomas Creek (mostly privately owned and just north of the analysis area), Potato Bill Creek (part pvt./ part NFS), and Nettle Creek (NFS) are trail-free (there are no trails going up those drainages). These are the only substantial drainages in the Crystal River valley without trails and their association protects a large habitat block on the northwest and north sides of Mt. Sopris.

6.5.3 Wildlife Access to the Crystal River

The potential CROS, RWP, and J&F trail segments occur on public lands that provide approximately six miles of unfettered year-round wildlife access to the Crystal River. The Red Wind Point and Filoha Meadow areas are two of the few places where critical sheep and elk habitats extend down to the Crystal River.

6.5.4 Crystal River Riparian Corridor

The Crystal River supports a botanically diverse, structurally varied, and locally broad riparian corridor. This habitat and its associated wetlands generally support the highest wildlife diversity and abundance of any local habitat. All of the new bridges that would be needed to access potential trail segments east of the river would affect flanking riparian habitat to some extent. Broader widths of riparian habitat that would have to be cleared to accommodate potential bridges occur at the north end of the CROS trail segment and the north end of the J&F trail segment. Sections of all three potential trails east of the river have railroad grades bisecting riparian habitat. It is unknown to what extent additional riparian clearing would be required to develop a functional trail corridor, but that would be a concern.

Similarly, the railroad grade closely approaches the very top of the riverbank in many places where additional clearing to obtain adequate trail width could result in further riparian losses and present water quality and aquatic habitat challenges. These same issues would also be valid concerns associated with a trail along Highway 133.

6.5.5 Other Localized Habitat Features

There are other more localized rare plant and unique wildlife habitats along the Crystal River. Many of these occur on Open Space parcels, located and identified because of more rigorous study (e.g., Colorado Wildlife Science 2008). Some of these, such as the hot springs and mineral licks at Filoha Meadows, have been previously addressed. Others, including, but not limited to rare plants, fireflies, abandoned mines supporting a maternity roost of pale Townsend's big-eared bat (a USFS R2 sensitive species), beaver ponds, a great blue heron nesting area, etc., occur on some of the open space parcels and elsewhere in the valley. Filoha Meadows is particularly rich in these resources. However, few of these resources would be affected directly by trail siting and use, although all could be affected by trampling and other disturbances associated with off-trail use and new access to the otherwise largely inaccessible areas supporting these species.

7.0 POTENTIAL TRAIL EFFECTS ON WILDLIFE AND HABITATS

Wildlife issues have been a major concern associated with a public recreation trail in the Crystal River valley in all prior analyses that considered local natural resources. Many of the basic issues are the same as those identified in the early 1990's. Other wildlife issues have emerged as recreational use and its effects on wildlife have increased in and beyond Pitkin County, as bicycle technology has improved, as more scientific studies have examined this issue, and as user's behaviors have evolved. This section, developed for the interested public and Decision Makers as they consider the best alignment for the Crystal Valley trail, provides the scientific basis for assessing wildlife impacts associated with various Crystal River trail segments. It starts with a summary of general effects that recreationists can have on wildlife, then provides summaries of detailed case studies relevant to the wildlife community in the Crystal River valley.

7.1 GENERAL EFFECTS OF RECREATIONAL USE ON WILDLIFE

In their comprehensive synthesis, *Wildlife and Recreationists*, Knight and Gutzwiller (1995) stated:

> "Outdoor recreation has historically been viewed as an environmentally benign activity. Yet with growing numbers of recreationists visiting public lands, and with a greater understanding of the role of public land in safeguarding biodiversity, it is becoming apparent that the effects of recreation on both the environment and wildlife are chronic and pervasive."

Outdoor recreational activity has increased enormously and will continue to increase, while the amount of land free of human disturbance and available for effective wildlife use has decreased and will continue to do so. Outdoor enthusiasts rarely view themselves as having a degrading effect on the environment (e.g., Flather and Cordell 1995, Hamman et al. 1999). Long ago, Boyle and Samson (1983) reported that in 81% of 166 studies reviewed, nonconsumptive outdoor recreation had negative effects on wildlife. Most recently, Larson et al. (2016) analyzed 274 scientific articles on the effects of non-consumptive recreation on animals worldwide. Of 93% of the articles documenting at least one effect

of recreation on animals, 59% were classified as negative effects. Most articles focused on mammals (42%) or birds (37%). Counter to public perception, non-motorized recreational activities had greater negative effects than motorized activities. Examples of other literature reviews and synthesis studies relevant to wildlife and recreationists include Joslin and Youmans (1999), Olliff et al. (1999), Lathrop (2003), and Marzano and Dandy (2012).

The conflict between wildlife and recreationists is not rocket science. The issue has been examined worldwide. Most research is from the United States, but considerable research, and even synthesis studies, is available from Europe, Canada, Australia, and New Zealand.[20] In the U.S., recreational effects on wildlife have been examined in National Parks being "loved to death" (e.g., Lee et al. 1984, Olliff et al., 1999), at National Wildlife Refuges (e.g., Drabelle 1985, Pomerantz et al. 1988), in travel management plans associated with the most heavily recreated National Forest in the U.S. (USFS 2011a,b), and in cities with some of the largest open space systems in the U.S. (e.g., Miller et al. 1998, 2001). Management plans have been implemented at all these levels attempting to allow wildlife and recreationists to coexist. Wildlife managers know what works, what doesn't, and why. When trail siting and management don't work, the trail and associated wildlife impacts generally remain. It is rare for trails, once built, to be decommissioned, even when negative effects are known and documented.

All types of recreation can negatively affect wildlife. Wildlife see humans hiking, with or without their dogs, and those on snowshoes, skies, or bikes as predators (Bowles 1996) and flee a certain distance to where the humans are no longer perceived as an immediate threat. That displacement distance and the zone of influence[21] surrounding trails, varies by wildlife species. It may be a matter of dozens of yards (e.g., for birds) or hundreds of yards and over a ridge (e.g., for elk). It is the animal's displacement from otherwise effective habitat (affecting hundreds of acres or more), the associated energetic expenditures (Ward and Cupal 1979, MacArthur et al. 1982, Gabrielsen and Smith 1995), and the loss of foraging and resting time (Hobbs 1989, Knight and Cole 1995a) that represent the greatest negative effects of trails, not the direct loss of a few acres of habitat from a trail several feet wide, albeit miles long (Taylor and Knight 2003).

Wildlife responses to human disturbances are influenced by (1) the type of disturbance, (2) the predictability of the disturbance, (3) the frequency and magnitude of the disturbance, (4) the time of year the disturbance occurs, (5) the relative location of the disturbance (above vs. below on a slope), and (6) the type of animal disturbed (including size, specialized versus generalized niche, group size, and sex and age; Knight and Cole 1995b).

First, a recreationist's speed and behavior can influence wildlife responses (e.g., Richens and Lavigne 1978, Burger 1981, Klein 1993). Rapid movement directly towards wildlife frightens them, while movements away or at oblique angles to the animal are less disturbing. Slow moving disturbances generally elicit milder responses from wildlife. Snowmobiles moving at high speeds alarmed white-tailed deer more than those moving at slower speeds, but when people stopped to observe the deer, they invariably caused the deer to flush (Richens and Lavigne 1978).

Second, disturbance predictability influences an animal's response. When animals perceive a disturbance as frequent enough to be "expected" and non-threatening, they show little overt response.

[20] This analysis almost entirely limits studies cited to those conducted in North America, if not only the U.S., and to those specific species and wildlife groups that could be affected by the Crystal River trail proposal, unless otherwise warranted.

[21] The "area of influence" is generally considered to be indicative of the relative impacts of recreational activities. Area or zone of influence is defined as the area that parallels a trail or line of human movement within which wildlife will flush from, or be otherwise affected by, a particular activity with a certain probability (Miller et al. 2001).

In Alberta, bighorn sheep encountering passing vehicles at 25-30 vehicles per hour showed minimal (<1%) avoidance and minor (<9%) increased heart rates (MacArthur et al. 1982). The same habituation of sheep to high-speed traffic can be seen along I-70 northeast of Georgetown, where 2015 traffic volumes were 36,000 average annual daily vehicles.[22] Feeding bald eagles were more vigilant and fed less in areas of active persecution compared to sites where birds were unharmed (Knight and Knight 1986).

On-trail recreation may appear more predictable to wildlife because it occurs frequently and along a particular line of movement, and animals in non-hunted populations may habituate somewhat to this type of activity (Knight and Cole 1995a, Whittaker and Knight 1999, Taylor and Knight 2003). If recreationists believe they can approach wildlife more closely than animals will actually allow, then recreationists will disturb wildlife in a majority of encounters. Animals flushing from recreational activity may come at the cost of energy needed for normal survival, growth, and reproduction (Geist 1978), and may cause animals to avoid otherwise suitable habitat (Hamr 1988, Gander and Ingold 1997, Miller et al. 2001). By understanding and altering recreationists' perceptions with regard to their impacts on wildlife, public lands managers can influence visitor behavior and reduce the potential negative effects of recreation on wildlife.

Third, when animals perceive a disturbance as frequent and threatening, they exhibit a more acute response. The most acute responses are to unpredictable, erratic, and threatening disturbances. There are thresholds of disturbance frequencies above which wildlife reduce their use or abandon habitats. For example, in Missouri, when human activity levels exceeded 0.45 hunters per hectare (1 ha. = 2.47 ac.), white-tailed deer movements increased (Root et al. 1988). Four species of waterbirds in Wales virtually abandoned areas when recreation exceeded 8-10 boats on a lake at any one time (Tuite et al. 1983).

Fourth, recreational use can be most detrimental to wildlife during the breeding season (for birds, with the greatest sensitivity during nest building and incubation) and winter (for ungulates, on negative energy budgets), however disturbance at other times of the years can also have appreciable negative effects (Hobbs 1989, Skagen et al. 1991). Breeding season disturbance may affect an individual's productivity, while winter disturbances can affect energy balances and an individual's survival. Mammals show less and weaker responses to humans during the winter months than at other times of the year. Ungulates respond less to recreationists when snow is deep, forage inaccessible, temperatures are lowest, body reserves are depleted, and energy conservation is decisive for survival. Under such conditions, ungulates are starving and can't afford the additional energy expenditures to flee (Parker et al. 1984). However, it has been shown repeatedly, and for virtually every ungulate species in North America, including (1) bighorn sheep (MacArthur et al. 1979, 1982, Stemp 1983, Geist 1971, Geist et al. 1985, MacArthur and Geist 1986, Hayes et al. 1994), (2) elk (Ward and Cupal 1979, Lieb 1981, Chabot 1991, Cassirer et al. 1992, Phillips 1998, Phillips and Alldredge 2000), and (3) mule deer (Freddy 1977, 1984, 1986, Freddy et al. 1986), that even minor, seemingly harmless human disturbances causes elevated heart rates that can result in relatively high energy expenditures (Stemp 1983, Chabot 1991, Canfield et al. 1999). This can lead to habitat avoidance, lowered body weight, increased starvation probabilities, increased susceptibility to predators, and smaller pre-winter body mass of offspring leaving them less fit for overwinter survival.

Fifth, wildlife often show more pronounced responses to disturbances above and closer to them as greater threats to their safety and ability to escape. Hikers approaching bighorn sheep from above

[22] http://dtdapps.coloradodot.info/otis/TrafficData#ui/1/1/0/station/103036/criteria/070A/0/449.589/true/true/

elicited stronger reactions than hikers approaching from below (Hicks and Eldar 1979). While nesting peregrine falcons were disturbed by recreationists at the base of their nesting cliffs, any approach from the cliff top elicited a more immediate and intense alarm (Herbert and Herbert 1965).

Sixth, larger wildlife generally flush at greater distances than smaller species. Animals feeding in groups detect and respond to approaching threats at greater distances and are less vulnerable to attack than individuals.

Negative trail use effects can occur year-round and affect all wildlife present to some extent. Even temporary displacement of breeding birds from a trail corridor can disrupt breeding activity, increase vigilance, reduce foraging time, the amount of prey brought to the nest, the number of chicks fledged, and cause nest abandonment (e.g., Luckenbach 1979, Knight and Gutzwiller 1995, Miller et al. 1998, Hamann et al. 1999). At certain levels of trail use, some width of otherwise suitable habitat along trail corridors may either be avoided or abandoned entirely during the nesting season. Miller et al. (1998) investigated the influence of recreational trails on breeding bird communities in forest and mixed-grassland habitats in Boulder County, Colorado. Bird species composition was altered adjacent to trails in both habitats. Generalist species were more abundant near trails, whereas specialist species were less common. Within the grasslands, birds were less likely to nest near trails. Within both habitats, nest predation was greater near trails. The average zone of influence of trail use extended about 241 feet away from trails, but extended to more than 320 feet for some sensitive species. Trail corridors and their use can also fragment songbird habitat by disrupting continuous effective habitat and reducing the patch size of interior habitat (e.g., Rich et al. 1994, Hutto 1995, Hamann et al. 1999, Malone and Emerick 2003).

For sheep, elk, and mule deer, the effects of recreationists are a year-round issue. Disturbance on summer range was once thought to be less of a concern because it is the most widespread seasonal habitat. However, the quality and availability of spring, summer, and fall ungulate forage is now known for its importance (1) to males growing antlers, horns, and fat reserves for the fall rut, (2) to females to meet the energy demands of lactation while simultaneously recovering from prior winter and pregnancy weight losses, and (3) to both sexes for building fat reserves to maximize upcoming winter survival probabilities (e.g., Verme 1967, Mautz 1978). Recreationist impacts on all other ranges, including spring and fall transitional ranges (i.e., migration), production (lambing, calving, and fawning) areas, and the various winter ranges can also be appreciable. Winter range is the most spatially restricted seasonal habitat and its availability generally dictates the size of a local herd. Big game are starving when on winter range (Mautz 1978). The forage they eat on winter range is insufficient to meet their metabolic needs, but it slows the rate of starvation. Reduced forage availability in recreational corridors and the increased energy expenditures fleeing recreationists have contributed to smaller herd sizes and reduced productivity of local big game herds (Will et al. 2011, Mao et al. 2013). In 2011, the CDOW reduced the mule deer population objective for the local Data Analysis Area containing the Crystal River valley, in part because of negative recreation effects (Will et al. 2011).

While most investigations of recreationist-wildlife interactions have focused on ungulates and birds (because of recreational, social, economic interest, and ease of study), human recreational activities have been documented to impact other wildlife groups, including herpetofauna (e.g., Hecnar and M'Closkey, 1998; Lacy and Martins, 2003; Rodrıquez-Prieto and Fernandez-Juricic, 2005), rodents (e.g., Mainini et al., 1993; Malone and Emerick 2003, Magle et al., 2005), and mesocarnivores (e.g., Malone and Emerick 2003, George and Crooks 2006).

With increased trail development and recreational use in recent decades, some of the associated negative effects on wildlife have been caused by social trail[23] development. In Eagle County, within several miles of trailheads, there is often no effective habitat; no ridge for animals to cross over to escape recreational activity (e.g., Havlick 2002). These trails meet a growing community need, yet despite their impacts on wildlife, there is little to no effective enforcement to reduce social trail use or decommission such trails. Once wildlife are displaced from high use areas, recreational enthusiasts assert that wildlife are no longer present and seek to have the trails adopted as part of the local/ regional trail system. Such trail use is not limited to Eagle County. It is occurring in and between many of Colorado's communities surrounded by large tracts of public lands. The Crown is a local example in Pitkin County where habitat succession and year-round human recreation have diminished mule deer winter range habitat quality (Will et al. 2011).

Lastly, this analysis did not seek to examine whether hikers or bikers had different impacts on wildlife. That question is irrelevant for this project, since a multi-use trail is proposed. Various studies showed interesting results, but all studies showed that both uses can have negative effects on the wildlife species warranting protection in the Crystal River valley. A crucial consideration that has been ignored in virtually all of the case studies summarized below, is the different distances that different recreationist groups travel. For example, even if hiker vs. biker impacts per animal encounter are equal, because bikers typically travel several times as far as hikers, bikers have the opportunity to disturb more wildlife per unit of time (Taylor and Knight 2003) and, therefore, can have several times as much impact on wildlife as hikers if total incidents and area of habitat affected are considered.

7.2 PERTINENT WILDLIFE - RECREATIONIST CASE STUDIES

For this analysis, recreational trail use focuses on hikers and bikers, the two anticipated principal user groups of the Crystal River trail. Below are several case studies documenting wildlife responses to different user groups that are pertinent to the particular species and potential trail issues in the Crystal River analysis area.

7.2.1 Freddy et al. (1986) - Mule Deer; Persons on foot vs. Snowmobiles

In North Park, Colorado, Freddy et al. (1986) compared the overt behavioral responses of adult female mule deer (in a hunted population) to humans on foot (usually on snowshoes) and snowmobiles. Snowmobiles will be prohibited on the Crystal River trail, but the study is relevant regarding deer reactions to persons afoot, their flight distances, and trail corridor effects. Mule deer were disturbed more by persons afoot than by snowmobiles. This finding supported previous research that persons afoot elicited more intense reactions by ungulates than they do to vehicles (Ward et al. 1976, Richens and Lavigne 1978, Schultz and Baily 1978, Eckstein et al. 1979, MacArthur et al. 1982). Responses by deer to persons were longer in duration, involved running more frequently, and were greater in estimated energy expenditures. Intensity of responses by deer was dependent on distances between animals and disturbances. Snowmobiles elicited initial attention by deer at greater distances than humans on foot, but deer ran away from persons on foot starting at greater distances than from snowmobiles. Freddy et al. (1986) concluded that minimizing all levels of deer responses (e.g., mild alert, moderate alert [lying animals stood or foraging ceased], and flight) would require persons afoot and snowmobiles to remain 365 and 514 yards from deer, respectively. Further, preventing flight by deer would require persons on foot and snowmobiles to remain 209 and 145 yards from deer,

[23] Defined in Section 3.1.

respectively. These flight distances from persons afoot and snowmobiles were similar to values documented for mule deer and elk elsewhere (Ward et al. 1976, Schultz and Baily 1978, MacArthur et al. 1982). Freddy et al. (1986) further noted that (1) their threshold distances could be used to establish corridors of human activity within sagebrush winter ranges occupied by deer that may reduce the effects of human intrusion and (2) that if human activities were restricted to trails (i.e., specific disturbance corridors), deer might perceive the activity as more predictable and acceptable (MacArthur et al. 1982).

7.2.2 Taylor and Knight (2003) - Mule Deer; Hikers and Mountain Bikers

Taylor and Knight (2003) examined the responses of three big game species, including mule deer, to hikers and mountain bikers at a Utah State Park by comparing animal alert distance, flight distance, and distance moved. The study did not include experimental controls needed to assess cause-effect relationships or consider quantitatively the different distances that hikers and bikers travel (they only measured animal responses per incident). At 100 m from a trail, mule deer exhibited an approximate 70% probability of flushing from on-trail recreationists. Mule deer exhibited a 96% probability of flushing within 100 m of recreationists off trails and their probability of flushing did not drop to 70% until the perpendicular distance from recreationists reached 390 m. Study results indicated that there was little difference in wildlife response to hikers vs. mountain bikers on a per encounter basis. Taylor and Knight (2003) speculated that characteristics of each activity may have affected the wildlife responses. While both activities involved humans traveling by non-motorized means, hikers retained their human form while mountain bikers appeared unlike humans because they were on a bike. Typically, pedestrians induce a more intense wildlife response than do motorized vehicles, because animals are thought to react most to the human form (Richens and Lavigne 1978, Eckstein et al. 1979, MacArthur et al. 1982, Freddy et al. 1986). However, mountain bikers travel at a higher speed and are less apt to be talking than hikers, which may cause mountain biking to be less predictable for wildlife. They speculated that the lack of difference in wildlife responses to hiking vs. biking (per incident) may be attributable to a balance between the disturbing attributes of each activity. Based on observed flushing responses, Taylor and Knight (2003) found the area around existing trails that may be impacted by recreationists on those trails was a 200-m "area of influence." Taylor and Knight (2003) also surveyed 640 backcountry trail users to investigate their perceptions of the effects of recreation on wildlife. Approximately 50% of recreationists felt that recreation was not having a negative effect on wildlife. Most recreationists felt that it was acceptable to approach wildlife at a much closer distance (mean acceptable distance to approach = 65 yds.) than wildlife would typically allow a human to approach (mean flight distance of all species = 165 yds.). Recreationists also tended to blame other user groups for stress to wildlife rather than holding themselves responsible. Taylor and Knight (2003) concluded that if management objectives include minimizing disturbance to wildlife habitat, new trails should follow existing edges and avoid water and forage resources, wildlife travel corridors, and escape terrain. That conclusion has remarkable applicability to the Crystal River trail siting.

7.2.3 Miller et al. (1998, 2001) - Mule Deer and Birds; Pedestrians and Dogs

On City of Boulder Open Space, Miller et al. (1998, 2001) measured the summer responses of mule deer and three bird species to on- and off-trail pedestrians alone, a pedestrian with a dog on-leash, and a dog alone. Mule deer exhibited the greatest response when a pedestrian was accompanied by a dog on leash and greater responses to off-trail interactions where activities were less frequent and predictable. That finding regarding greater wildlife responses to unpredictable disturbances was

consistent with other studies (e.g., Schultz and Baily 1978, MacArthur et al. 1982, Hamr 1988). Boulder Open Space regulations have no leash laws (dogs under sight or voice control only) and dogs are known to harass and attack deer. Miller et al. (2001) speculated that because dogs are common on open space trails and rarely leashed, deer have become sensitized to the presence of dogs, explaining the greater reaction of when a pedestrian was accompanied by a dog. Birds (vesper sparrow [*Pooecetes gramineus*], western meadowlark [*Sturnella neglecta*], and American robin [*Turdus migratorius*]) also exhibited greater responses when disturbances occurred off-trail vs. on-trail. Vesper sparrows and western meadowlarks showed the least responses to dogs alone and the greatest responses when a pedestrian was present. The authors speculated that because dogs resemble coyotes (*Canis latrans*) and because coyotes rarely prey on birds, bird may not perceive dogs as a significant threat. However, dogs may pose a greater threat to birds than humans, so birds may hold their position to the last moment attempting to remain undetected. Bird responses to pedestrians alone and a pedestrian with a dog on-leash were similar, indicating that the presence of a dog with a pedestrian did not have an additive effect. Off-trail recreation is infrequent and spatially unpredictable, thus birds unaccustomed to such activities exhibit greater responses.

7.2.4 Naylor et al. (2009) - Elk; ATV Riding, Mountain Biking, Hiking, & Horseback Riding

Naylor et al. (2009) measured responses of elk to four types of recreational disturbance: all-terrain vehicle (ATV) riding, mountain biking, hiking, and horseback riding, to determine if different types of recreation elicited different responses. Elk travel time (i.e., associated with flight) increased in response to all four disturbances, which reduced time spent feeding or resting. Travel time was highest during ATV exposure, followed by exposure to mountain biking, hiking, and horseback riding. Feeding time decreased during ATV exposure and resting decreased when elk were subjected to mountain biking and hiking disturbances. Resting time was similar during both mountain biking and hiking replicates. There was no difference in duration of feeding between mountain biking and hiking treatments. Elk showed no evidence of habituation to mountain biking. Reduction in foraging time as a result of disturbances was not compensated for after the disturbance ended, because elk did not increase feeding intensity or duration beyond that of controls. Their results demonstrated that elk activities can be substantially affected by off-road recreation. Specifically, off-road recreation produces a change in elk behavior and different types of human activity cause different behavioral responses in elk.

7.2.5 Papouchis et al. (2001) - Desert Bighorn Sheep; Vehicles, Mountain Bikes, & Humans on Foot

Papouchis et al. (2001) compared behavioral responses of desert bighorn sheep to recreational activity (vehicles, mountain bikers, and humans on foot) between a low visitor use area and a high visitor use area in Canyonlands National Park, Utah. They found that sheep exhibited a greater probability of flushing, longer distances moved, and longer response durations when disturbed by hikers compared to mountain bikers or vehicles. Responses of bighorn sheep were greater when human activity approached at the same elevation, when sheep were moving or standing, when interactions with ewes occurred in spring and summer and when with rams interactions occurred in autumn, and when sheep were farther from escape terrain. Their results contrasted with the results Taylor and Knight (2003). The difference in findings between the two studies may be attributable an experimental design artifact. Papouchis et al. (2001) compared the responses of sheep approached directly and off-trail by hikers (research assistants who were told to meander towards the sheep) with those of sheep approached tangentially on a road or trail by mountain bikers and vehicles. Generally, wildlife exhibit a stronger

response to humans that approach them directly and to humans located off designated trails (MacArthur et al. 1982, Moen et al. 1982, Knight and Cole 1995a, Miller et al. 2001). Therefore, the differences in sheep response to hiking and mountain biking seen in Papouchis et al.'s study actually compared hikers that approach bighorn sheep directly and off-trail and on-trail bikers that ride by sheep.

7.2.6 Malone and Emerick (2003) - Impacts of Trails and Recreationists on Wildlife

In Pitkin County, Malone and Emerick (2003) evaluated the effects of multi-use recreational trails on breeding birds, small mammals, mesocarnivores (e.g., weasels, raccoons, and red fox up to black bears), and vegetation structure in four habitat types. Comparing survey results between treatment and control areas, vegetation structure between on- and off-trail point-pairs was generally >90% similar. However, similarity between on- and off-trail animal communities was always much less than 90% and varied with ecosystem and animal community studied. Breeding bird, small mammal, and mesocarnivore community composition (i.e., species abundance and distribution) differed between on- and off-trail plots in each habitat. Along trails, the bird community was dominated by human tolerant species and those species that benefitted from the trail habitat. Birds intolerant of disturbance were not detected within 30m of trails. The zone of trail influence varied with species, but was frequently observed at about 30m. Thus, trails seemed to affect bird community composition for at least a 60m wide corridor. That was a narrower zone of influence than the average zone of influence found around pedestrian trails in Boulder (Miller et al. 1998, see Section 7.2.3, above), although that may be due to definitions used and habitat differences. Along trails, the small mammal community was dominated by disturbance indicator species and specialist mammals were more frequently captured away from trails. Trails with increased human use experienced greater changes in abundance, diversity, and composition of the small mammal community. Along trails, the composition and distribution of mesocarnivores differed. Edge-adapted, open-country, mesocarnivores (e.g., red fox) were more common, while interior species (e.g., American marten) were never detected along trails.

Malone and Emerick (2003) concluded that even narrow and lightly used recreational trails can fragment forests, create smaller, isolated forest patches, increase habitat edge effects, and alter wildlife community composition. Wildlife species respond to trails and their associated disturbances in different ways. To some species, trails present a challenge and warrant avoidance. Trails present an advantage to other species, who seek them out. Some species are successful in trail corridors while others may be displaced. Trail-induced edge effects don't stop at the trail edge. Trail-effects permeate the interior of adjacent habitats. Edge-adapted mesocarnivores invade forests on trails and humans displace these species away from the trail, further into the forest. Recreational disturbances and predation pressures radiate from trails into surrounding wildlife communities, enlarging the zone of disturbance that surrounds the trail corridor and affecting wildlife both along and away from trails.

While the effects of recreational trail use on wildlife measured by Malone and Emerick (2003) were apparent, their results could also explain why some recreationists misunderstand their effects on wildlife…wildlife always seem to remain. In this study, in some habitats, the on- and off-trail bird communities were only 42% similar, but birds were still present to the casual observer. Common, disturbance-tolerant birds had replaced the less common intolerant birds near trails, but there were still birds to be seen.

7.2.7 Wisdom et al. (2005) - Mule Deer and Elk; ATV, Horseback, Mountain Bike, and Hiking

In a well-designed study, Wisdom et al. (2005) measured[24] effects of off-road recreation (ATV, horseback, mountain bike, and hiking activities) on mule deer and elk. Movement rates (i.e., associated with flight) were substantially higher for elk during the morning vs. afternoon disturbances for all four activities. This was attributed to elk moving away from the disturbance routes and avoiding them for the remainder of the day, which reduced the need for more travel and conserved energy, a finding also made by Naylor et al. (2009). Movement rates of elk during afternoon disturbances, however, stayed well above the rates observed during the periods of no human activity (control period). For morning disturbances, movement rates of elk were highest during ATV riding, second-highest during mountain bike riding, and lowest during hiking and horseback riding. Peak movement rates of elk during morning disturbances were highest for ATV riding (21 yds./min.), followed by mountain bike riding (17 yds./min.), and horseback riding and hiking (both about 15 yds./min.). In contrast, peak movement rates of elk during the control periods did not exceed 9 yards/minute. In contrast to elk, mule deer showed less change in movement rates during the four off-road activities compared to the control periods.

They estimated probability of elk flight from a human disturbance was highly dependent on distance. Higher probabilities of flight response occurred during ATV and mountain bike activity, in contrast to lower probabilities observed during hiking and horseback riding. Probability of a flight response declined most rapidly during hiking, with little effect when hikers were beyond 550 yards from an elk. By contrast, higher probabilities of elk flight continued beyond 820 yards from horseback riders, and 1,640 yards from mountain bike and ATV riders. Daytime movement rates of deer were higher, as compared to control periods, during mountain bike riding, horseback riding, and hiking, especially in the morning. Estimated probabilities of flight response for mule deer were nearly identical among all four activities and not significantly different for control periods, suggesting that deer were not exhibiting the same tendency for flight as shown by elk in relation to off-road activities.

Wisdom et al. (2005) concluded that off-road recreational activities appear to have a substantial effect on elk behavior. Animal energy budgets may be adversely affected by the additional energy required to flee from an off-road activity and from displacement from foraging habitat. In contrast to elk, mule deer showed little measurable response to the off-road disturbances. They speculated that deer may be responding to the treatments with fine-scale changes in habitat use, rather than substantial increases in movement rates and flight responses. For example, it is possible that deer may respond to an off-road activity by seeking dense cover, rather than running from the activity. Nevertheless, if mule deer are spending more time in dense cover, in reaction to any of the off-road activities, this could result in reduced foraging opportunities, and a subsequent reduction in opportunities to put on fat reserves during summer that are needed for winter survival.

7.2.8 Cassirer et al. (1992) - Elk, Cross-country Skiers

In northern Yellowstone Park, Cassirer et al. (1992) measured the immediate movements of adult female elk when disturbed by cross-country skiers to assess energy costs associated with movements and to identify factors influencing elk behavior. For this Crystal River analysis, results from one of the

[24] Electronically, using an automated telemetry system (to track animal movements) and GPS units (to track human movements), allowing control measurements to be made "blind," with no humans present.

three study areas (Mammoth Hot Springs) were excluded because those elk were habituated to humans (Crystal River elk are not habituated to humans). The median distance at which elk started to move in response to approaching skiers was 437 yards. The median distance that elk moved in response to skiers was 0.35 miles. After being disturbed, elk moved uphill, to steeper slopes, away from the road, and closer to trees. Distance moved was correlated with the distance to the nearest ridge and wind speed. Elk were displaced from the drainage for at least the duration of human presence and on average returned within two days. Elk responses did not seem to be affected by the total number of skiers, frequency of skier groups, or number of skiers in the first group. Energy expended moving away from skiers represented approximately 5.5% of an estimated average daily energy expenditure for elk in winter. This does not consider energy not gained as a result of lost foraging opportunities. Energy cost of movements increases exponentially with increasing snow depths (Parker et al. 1984) and would be most critical during winter, with reduced forage availability and when elk are in poor condition (Hobbs 1989). Cassirer et al. (1992) concluded that restricting cross-country skiers (or other recreational users) to locations >711 yards (or on the opposite side of a ridge) from elk wintering areas would probably minimize displacement of most non-habituated elk on shrub steppe winter range. Skiers (or other recreational users) would likely have to remain at distances of 0.35 miles to completely avoid disturbing elk. Locating recreational trails in areas with abundant topographic relief and providing wildlife security areas in drainages adjacent to where skiing occurs might minimize added energy costs and lost foraging opportunities.

7.2.9 George and Crooks (2006) - Bobcats, Coyotes, and Mule Deer; Snowfree Recreational Activities

George and Crooks (2006) investigated the relationship between human recreation and the spatial and temporal activity patterns of large mammals and mesocarnivores in an urban nature reserve. Results suggested that bobcats (*Lynx rufus*), and to a lesser degree coyotes (*Canis latrans*), exhibited both spatial and temporal displacement in response to human recreation. Bobcats were not only detected less frequently along trails with higher human activity, but also appeared to shift their daily activity patterns to become more nocturnal in high human use areas. Negative associations between bobcat and human activity were particularly evident for bikers, hikers, and domestic dogs. They did not find a clear and consistent pattern of avoidance of human recreation by mule deer, but the probability of detecting deer during the day was lower with increasing levels of human recreation.

7.2.10 Road Effects on Big Game Habitat Effectiveness - Summary

There have been thousands of studies examining the effects of highways and roads on wildlife and their habitats. Following Trombulak and Frissell (2000), the impacts of roads on wildlife may be grouped into seven categories: (1) mortality from road construction, (2) mortality from vehicle collisions, (3) modification of animal behavior, (4) disruption of the physical environment, (5) alteration of the chemical environment, (6) spread of exotic species, and (7) resulting changes in human use. As a synthesis of road effect issues most pertinent to the Crystal River trail project (categories 3 and 4, above), are the effects of roads on adjacent habitat effectiveness.

A number of studies have examined elk[25] response to roads. Vehicular use of roads adversely affects elk use of adjacent habitats (Burbridge and Neff 1976, Hershey and Leege 1976, Leege 1976, Marcum 1976, Perry and Overly 1976, Ward 1975, Ward et al. 1976, Hinschberger et al. 1978, Lyon 1979, Rost

[25] Hunted populations, non-habituated to humans.

and Bailey 1979, Johnson and Lockman 1981, Rowland et al. 2000). The same studies can be extrapolated generally to bighorn sheep and deer and more generally to the broader wildlife community. The zone of disturbance adjacent to roads that is avoided by elk has been reported as 220 yards to 1.8 miles, depending on the type and use of roads and the adjacent habitat. This zone is not completely abandoned by elk, but use of this area (i.e., the habitat effectiveness) may be reduced depending on a number of factors. Greater traffic volume on unpaved roads through more open habitats generally produces a wider zone of avoidance (Perry and Overly 1976, Hershey and Leege 1976, Rost and Baily 1979).

Habitat management guidelines for northern Idaho predict 10-70% reductions in elk use within 0.25 miles of open roads (Interagency Study Team 1977). One-quarter mile (1,320 yds.) is the distance most commonly used to assess the influence of proposed secondary roads, open to the public, on elk habitat effectiveness. Consistent with the other case studies above, it is not the roads themselves that elk avoid, but the disturbances associated with human activity along the roads. Elk show little or no avoidance of roads completely closed to vehicular traffic (Marcum 1976).

With respect to applying the above road effects studies to the Crystal River valley, those studies were conducted on "wild" elk herds. The hunted elk and deer in undeveloped areas of the Crystal River valley are not habituated to human activities to any extent; the bighorn sheep show some habituation in some areas and contexts. Based on the above, there is an existing zone of Highway 133 traffic disturbance that reduces adjacent wildlife habitat effectiveness (probably broadest for elk, followed by deer, and bighorn sheep) for 220 yards to one-quarter mile or more. Following Freddy et al. (1986) and Taylor and Knight (2003), as examples, the additional recreational use along a trail located within the existing highway disturbance corridor would likely have discountable additional contributions to habitat effectiveness that is currently impaired adjacent to the highway. Conversely, the recreational use zone of influence would be much greater for a new trail bisecting generally unused higher quality habitat, than for one closely paralleling and located within the existing Highway 133 disturbance corridor.

7.2.11 Case Studies Summary

The above case studies are examples of how wildlife respond to different recreational activities. The intent was not to provide evidence that one trail user group or another may be more problematic to wildlife, but to (1) educate the reader about how wildlife respond to different perceived threats and (2) provide examples of how all types of recreational activities can have negative effects on wildlife. Many other similar studies are available and some have been summarized in other Crystal River trail documents (e.g., Colorado Wildlife Science 2008, Wright 2015, 2017). Some of the older studies examining the wildlife-recreationist issue were used intentionally in this analysis to indicate how long (40+ years) the issue has been analyzed. Studies examining certain issues (e.g., the displacement of elk from roads) are no longer conducted because the issue has been "settled." Additional studies are warranted, but they are not necessary to make decisions for proposed multi-use trails. While further studies would refine our knowledge of how wildlife respond to recreation, there already exists a large body of scientific evidence documenting the significant and varied impacts recreation and human use of the landscape can have on wildlife. Our existing knowledge is sufficient to understand the impacts potential trail alignments would have on wildlife in the Crystal River valley.

7.3 POTENTIAL TRAIL EFFECTS CONCLUSION

Section 6.0 described the wildlife groups and species present in the Crystal River valley. Section 7.0 described how recreational use can affect wildlife negatively. To reiterate from Section 7.1, it is the animal's displacement from otherwise effective habitat, the associated energetic expenditures, and the loss of foraging and resting time that represent the greatest negative effect of trails, not the direct loss of a few acres of habitat from a trail several feet wide, albeit miles long. In the few case studies detailed, mule deer avoided people on foot that were 103 yards (Taylor and Knight 2003) to 365 yards away (Freddy et al. 1986). Elk avoided hikers (Wisdom et al. 2005), skiers (Cassirer et al. 1992), and bikers (Wisdom et al. 2005) that were 550, 711, and 1,640 yards away, respectively.

Conservatively (for impact assessment) applying Taylor and Knight's (2003, Section 7.2.2) findings for deer (i.e., that habitat within 100m of trails would be "potentially unsuitable"[26] for wildlife due to disturbances from recreation) to the conceptual 20-mile-long Crystal River trail and applying their terminology, 1,591 acres[27] (or 2.49 mi.^{2}) of habitat surrounding the trail could be negatively affected. This area would likely be larger for elk and similar, or smaller, for sheep. This 300-foot zone of influence on each side of the trail is not biologically conservative. For example, the Pitkin County Land Use Code (Section 7-20-70, [d], 2) requires 1,000-foot to one-quarter mile setbacks to protect some wildlife habitat areas. With this consideration in mind, the Crystal River trail could have moderate, but relatively minor effects (with a Highway 133, Redstone Boulevard, and Hayes Creek bypass alignment) on wildlife habitats and ecological communities, largely resulting from the Hayes Creek bypass. The remainder of the trail located within the highway disturbance corridor would have minimal effects because of existing chronic traffic effects. Following similar assumptions and discounting the additional indirect trail effects adjacent to the Highway 133 (see Section 7.2.10) and Redstone Boulevard (see Section 6.3.9) trail segments, habitats affected by that alignment would be limited largely to approximately 111 acres[28] (or 0.17 mi.^{2}) associated with the 1.4-mile-long[29] Hayes Creek bypass. Alternatively, a trail corridor could have the largest, single, negative effect to wildlife habitats in the valley since Highway 133 was upgraded in the late 1960's (with highway segments, three trail sections east of the river [totaling 6.8 mi.], the Hayes Creek bypass [1.4 mi.], and the old McClure Pass switchbacks [2.8 mi.]) because of effects to 11.0 miles of trail located in currently buffered, isolated, interior, highly effective, and unfragmented habitats. Following the same assumptions, the collective off-highway trail alignments would affect 875 acres (or 1.37 mi.^{2}),[30] 7.9 times the area of the Highway 133/ Redstone Boulevard/ Hayes Creek bypass alignments.

[26] In the author's opinion, this is an overstatement by Taylor and Knight (2003). More accurately, this zone of influence would experience reduced habitat effectiveness and habitat would remain suitable, though impaired to a certain extent.

[27] 200m * 3.281 ft./m = 656.2 ft. (656.2 ft. * 18 mi. * 5,280 ft./mi.)/ 43,560 ft^2/ac. = 1,591 ac. = 2.49 mi.^{2}. This assumes, simplistically, that all habitat within 100m of trails is currently functional, is occupied by animals, would be exposed to recreational disturbances along trails, does not have overlapping zones of influence, etc. While this quantification may be inexact, it provides relative quantifications of the habitat area that could be affected by trail use.

[28] 200m * 3.281 ft./m = 656.2 ft. (656.2 ft. * 1.4 mi. * 5,280 ft./mi.)/ 43,560 ft^2/ac. = 111 ac./640 ac./mi^2 = 0.17 mi.^{2}.

[29] As measured in this analysis.

[30] 200m * 3.281 ft./m = 656.2 ft. (656.2 ft. * 6.8+1.4+2.8 mi.) * 5,280 ft./mi.)/ 43,560 ft^2/ac. = 875 ac. = 1.37 mi.^{2}.

8.0 TRAIL RECOMMENDATIONS

This section considers potential sections of the Crystal River multi-use recreation trail identified in the West Elk Loop Scenic & Historic Byway Crested Butte to Carbondale Trail Feasibility Study (Newland Project Resources 2004) and summarizes their effects on wildlife and ecological resources. A trail alignment is identified that would have the least negative effects. As described above, the Newland trail alignments were used because they are the most recent specific trail alignments. Any specific route chosen by Pitkin County or the Forest Service may follow a slightly different alignment, however due to the topography and broad areas covered by wildlife habitat those differences are unlikely to affect the conclusions of this report. Mitigation measures to avoid, minimize, and mitigate negative effects are identified for the preferred alignment and for other potential trail sections that might be selected. To the extent this report is ambiguous or does not address certain matters, decision makers are encouraged to follow the recommendations of the local staff of the state wildlife management agency, Colorado Parks and Wildlife. They are the wildlife professionals who have spent the most time on the ground in the Crystal Valley.

8.1 POTENTIAL TRAIL SEGMENT WILDLIFE CONSIDERATIONS

8.1.1 Redstone Boulevard

The Redstone Boulevard bypass would have no meaningful, negative, direct or indirect effects on wildlife and the adjacent ecological community because it is an existing paved road, largely through existing development, that is currently functional as a share-the-road trail. Of all trail segments, it would have the least negative effects.

8.1.2 Highway 133 Corridor

In the most recent trail feasibility study to date, Newland Project Resources (2004) indicated that with the exception of Hayes Creek Canyon, where a potential 1.5 mile bypass was identified, a bike trail could be located alongside, or offset from, Highway 133 through the entire length of Pitkin County's Crystal River Trail analysis area (T. Newland, Newland Project Resources, pers. comm., Mar.23, 2017). A trail associated with the Highway 133 corridor would cross through some important wildlife habitats and result in direct and indirect habitat losses. However, all of the affected habitat would be within the highway's existing zone of influence where habitat effectiveness has already been reduced for most species and adjacent habitat generally avoided by most wildlife, including those species of greatest concern (sheep and elk). Locating trail activity disturbances within an existing disturbance corridor would minimize the additional disturbances to wildlife (e.g., Freddy et al. 1986, Taylor and Knight 2003). The new recreational activity that would occur along the trail adjacent to the highway ROW would appear as predictable benign disturbances that generally elicit less intense wildlife responses (e.g., Schultz and Baily 1978, MacArthur et al. 1982, Hamr 1988).

The Highway 133 trail alignment would provide the following advantages and benefits to wildlife:

1. It would locate the direct (trail construction) and indirect (trail use) trail effects almost entirely within[31] an existing, chronic, human activity corridor.

[31] With the possible exceptions of the two short bypasses near the top of McClure Pass to avoid erosive highway road cuts (see Section 8.1.4).

2. It would avoid all critical wildlife habitats that were not already impaired by existing highway traffic effects.
3. With the exception of the Hayes Creek bypass, the highway alignment would completely avoid introducing relatively high levels of human disturbance into currently buffered, isolated, highly effective, and large unfragmented blocks of critical wildlife habitat east of the river.
4. The highway trail alignment would bisect some important wildlife habitats and occur close to (within ¼ mile of) some critical habitats. Some direct disturbances associated with trail development along the highway could have negative effects on some wildlife species (e.g., potential removal of decadent cottonwoods used by nesting Lewis' woodpeckers). However, the highway trail alignment would almost entirely avoid the more concerning indirect effects associated with animal displacement from active trails (i.e., it would not expand the highway's existing zone of influence). There should be minimal, additional, recreational use displacement of big game from habitats flanking the highway if the trail is located within the highway's existing zone of disturbance. Therefore, the highway trail alignment would avoid the need for seasonal closures to protect critical and important wildlife habitats because local wildlife have already adapted to existing traffic effects (either through habitat abandonment or behavior modification) and the additional recreational use within the highway corridor should only have insignificant incremental disturbances.
5. The Highway 133 trail alignment would largely maintain the status quo for wildlife in the Crystal River valley and avoid considerable, significant, year-round impacts to critical sheep and elk habitats and impacts to imperiled and important habitats outside existing disturbance corridors supporting a high diversity of other plants, plant communities, and animal species.
6. The Highway 133 trail alignment would avoid the need to build new bridges across the Crystal River, which would fragment and bisect some locally broad areas of riparian habitat (e.g., up to 121 feet wide at the likely site of a bridge to access the north end of the CROS property).
7. The Highway 133 trail alignment would continue the impediment to public access to large blocks of trail-free and largely unused (by humans) NFS lands on the east side of the river containing critical and important wildlife habitats that could be impacted by the increased access and use provided by any trail alignments on the east side of the river.

8.1.3 Hayes Creek Canyon Bypass

The abandoned Bear Creek railroad grade, bypassing Hayes Creek Canyon, was identified as a potential off-highway trail segment because a trail could not be safely located along the highway through the canyon (Newland Project Resources 2004). There are important wildlife habitats (though none designated as critical by CPW) that would be bisected by the bypass trail in an area of approximately 111 ac. (0.17 $mi.^2$, see footnote 29) and other adjacent habitat that could be negatively affected by unintended consequences of the bypass trail (see the peregrine falcon and elk subsections in Section 6.3, above). Approximately 30% of that trail segment would be within one mile of an active peregrine falcon eyrie, occupied between March 15 and July 31. If it is determined, after further analysis, that a trail cannot be constructed thorough Hayes Creek Canyon adjacent to Highway 133, then the only alternatives are to either let trail users continue to follow the highway, as they do now, or construct the bypass, with immutable long-term commitments (see Section 8.2) to avoid, minimize, and mitigate negative impacts to vegetation and wildlife. Should the bypass alternative in the EIS be selected by the

Responsible Official, a Forest Plan amendment would be required to address the inconsistency with WRNF Management Plan Forest-wide, Wildlife, Standard 8 and possibly 9.[32]

8.1.4 Old McClure Pass Road Switchbacks

The old McClure Pass Road switchbacks are currently used to some extent year-round. Their use is limited by parking availability, winter snowpack on the trail, and the site's relative remoteness from recreationist starting points. There are important wildlife habitats (though none designated as critical by CPW) that are bisected by the switchbacks that could be negatively affected by increased trail use, including breeding birds and the elk, bald eagle, black bear, and moose habitats, described in Section 6.3, above.

Because a recreation trail could likely be located along the highway or as a share-the-road option (better for wildlife) from the southern intersection with the Hayes Creek Canyon bypass all of the way up to the McClure Pass summit, with the exception of two short trail sections near the summit where the trail would swing to the north around steep erosive highway cuts (Newland Project Resources 2004), impacts to wildlife would be minimized if the trail was associated with the highway. Such a trail would occur largely within habitats whose effectiveness is already compromised by highway effects. Improving and increasing use of the old McClure Pass Road switchbacks through largely effective habitat would negatively affect a moderate number of important wildlife species in an area of approximately 223 ac. (0.35 mi.^{2}).[33] This recommendation, which would avoid an expanded (i.e., from existing conditions) zone of influence in habitats adjacent to the trail (i.e., as of result of trail upgrading and increased recreational use) would be most valid if the existing switchback trail was decommissioned effectively. If that would not be the case, then the above recommendation may still make sense if future use of the switchbacks was limited to on-foot activities (i.e., bikes excluded, to maintain near current trail use levels) and increased use was not encouraged by increasing parking availability for hikers (or if existing parking opportunities were eliminated). If such use restrictions were not implemented and enforced, then it would likely be better for wildlife if no new trail segment was built along the highway (although the two short trail sections near the summit would still be needed), and trail use increased along the existing switchback alignment, because such use would occur mostly outside the winter period when most, but not all, of the important wildlife use occurs.

8.1.5 Trail Segments East of the Crystal River

In general, the three potential trail segments east of the Crystal River that would follow the existing railroad grade would have the greatest negative effects on wildlife and other ecological resources compared to other potential trail segments. The railroad grade would require some improvements, some local bypasses, and other improvements that could have similar, negative direct effects to some wildlife species as described for the Highway 133 trail development. However, the significant potential

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[32] Forest-wide, Wildlife, Standards 8 and 9 of the White River National Forest Management Plan specify the following related to peregrines:

> 8. Discourage land use practices and development that adversely alter the character of peregrine falcon hunting habitat or prey base within ten miles of the nest site and the immediate habitats within one mile of the nesting cliff.
>
> 9. Human activities will be restricted within one-half mile of the occupied peregrine falcon areas between March 15 and July 31 for nest sites, or July 1 to September 15 for hack sites.

[33] 200m * 3.281 ft./m = 656.2 ft. (656.2 ft. * 2.8 mi. * 5,280 ft./mi.)/ 43,560 ft^2/ac. = 223 ac./640 ac./mi^2 = 0.3 mi.^{2}. See assumptions in footnote 28.

wildlife impacts resulting from these trail segments would be (1) the new and/or farther displacement of wildlife from the new and/or increased use of the trail corridors through otherwise undisturbed and/or effective habitat (affecting hundreds of acres), (2) the associated energetic expenditures of displaced animals (Ward and Cupal 1979, MacArthur et al. 1982, Gabrielsen and Smith 1995), and (3) the loss of animal foraging and resting time (Hobbs 1989, Knight and Cole 1995a) in adjacent habitat along the trails. The effectiveness of approximately 541 acres (0.85 mi.) of habitat[34] would be affected adjacent to these three trail segments. These effects represent the greatest negative consequences of trail development, not the direct loss of a few acres of habitat from upgrading an existing trail, albeit miles long (Taylor and Knight 2003).

Habitats that would be bisected by potential trail segments east of the river, and those more extensive habitats on NFS lands farther to the east, are currently difficult for the public to access due to the river, intervening private property, and limited public access portals (e.g., Avalanche Creek Road). The river provides an effective barrier to public access and buffers and isolates human disturbances west of the river from the high value habitats to the east. Those habitats are used by a wide variety of wildlife year-round. Some of those habitats are considered seasonally critical to bighorn sheep and elk. The value of those habitats is not only due to the large and unfragmented habitats present, but also because their isolation and the lack of human disturbance that allows the habitats to be used effectively.

Seasonal closures of at least the RWP and J&F segments would be warranted to minimize human disturbance in bisected critical elk and sheep habitats.[35] The J&F closure should extend from October 1 to June 30[36] (8 months) to protect sheep and elk habitat use periods,[37] consistent with the current seasonal closure. The RWP closure should extend from December 1 to April 30 (5 months) to protect critical sheep habitat,[38] consistent with the current seasonal closure. The potential CROS segment would not bisect nor closely approach (within 1/4 mile)[39] any critical habitat and would have the least negative effects on wildlife of the three trail sections east of the river. However, while the seasonal closures would minimize human disturbance in critical habitats, seasonal closures are not 100% effective and it has been the consistent opinion of CPW DWMs and other wildlife professionals that closures are difficult to enforce and are not sufficiently effective to protect critical wildlife habitat use (see Sections 5.6, 5.7.2, and 8.2.2). It takes a relatively few closure violations and few people to alter wildlife behavior and habitat use. Furthermore, when the trails are open, the associated recreational disturbances will negatively affect habitat use of the broader wildlife community in affected habitats on each side of the trail.

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[34] 200m * 3.281 ft./m = 656.2 ft. (656.2 ft. * 6.8 mi. * 5,280 ft./mi.)/ 43,560 ft²/ac. = 541 ac./640 ac./mi² = 0.85 mi.². See assumptions in footnote 28.

[35] In addition to the (1) elk winter concentration area and severe winter range (J&F) and (2) sheep winter concentration area (RWP) and migration corridor (J&F) bisected by these trail segments, they would also bisect non-critical, but important, sheep and elk winter range. While trail closures through such spatially limited habitats are warranted biologically, development in Pitkin County has not been required to avoid winter range, nor have trails through such habitats been closed to protect habitat values.

[36] This closure also apparently extends from May 30 to June 30 to protect current, undelineated elk calving use of Filoha Meadows.

[37] Sheep winter range and migration corridor; elk winter range, winter concentration area, and severe winter range.

[38] And to allow sheep access to the river during the winter, per the RWP Management Plan.

[39] While it is recognized that there is no one distance that would sufficiently buffer human effects from all wildlife use in all possible contexts, ¼ mile is used based on its use in the Pitkin County Land Use Code (7-20-70: Wildlife Habitat Areas) to protect important and critical wildlife habitats.

Trails east of the river would require the construction of new bridges across the Crystal River, which would fragment and bisect some locally broad areas of riparian habitat (e.g., up to 121 ft. wide at the likely site of a bridge to access the north end of the CROS property).

Trails east of the river would increase public access to large blocks of trail-free and largely unused (by humans) NFS lands on the east side of the river containing critical and important wildlife habitats that could be impacted by the increased access and recreational use.

8.1.6 Trail Siting Summary

Based on (1) the scientific literature, (2) prior Crystal River valley ecological analyses, (3) recommendations of wildlife professionals, (4) this updated wildlife-focused analysis, and (5) potential trail segments identified in the most recent trail feasibility study to date (Newland Project Resources 2004), the trail alignment that would have the least negative effects on wildlife and the ecological community would be an alignment located in existing, chronic, human activity corridors. As such, the trail should be located alongside, or offset from, Highway 133 through the length of Pitkin County's Crystal River Trail analysis area, to the extent possible. The Redstone Boulevard bypass would have no meaningful, negative, direct or indirect effects on wildlife because it is an existing road, largely through existing development, that is currently functional as a trail. If it is determined, after further analysis, that a trail cannot be constructed adjacent to Highway 133 through Hayes Creek Canyon, then the only alternatives are to either let trail users continue to follow the highway, as they do now, or construct and use the Hayes Creek bypass, with immutable long-term commitments (see Section 8.2) to avoid, minimize, and mitigate negative impacts to vegetation and wildlife). There are important wildlife habitats (though none designated as critical by CPW) that would be bisected by the Hayes Creek bypass trail and other adjacent habitats that could be negatively affected by the unintended consequences of the bypass trail.

The highway ROW locally supports habitats with high functional value to some wildlife species. However, there would be far fewer and less severe impacts to the wildlife community if the trail was located along and within the influence of a high speed highway rather than introducing eventually high levels of new trail use into generally unused (by humans), currently buffered and isolated, highly effective, and large unfragmented blocks of critical and important wildlife habitats east of the river. A highway trail alignment would preclude the need for new bridges crossing the river. New bridges would open public access to large blocks of trail-free and largely unused (by humans) NFS lands on the east side of the river containing additional critical and important wildlife habitats. Those habitats could be impacted by the increased access and use facilitated by trail alignments on the east side of the river. A highway trail alignment would also preclude the need for seasonal closures that are difficult to enforce and not 100% effective at protecting critical and important wildlife habitats.

8.2 RECOMMENDED MITIGATION MEASURES

This section provides measures and considerations that would avoid, minimize, and mitigate negative wildlife effects resulting from development and use of the Crystal River multi-use recreation trail. The measures address mostly "big picture" issues. More detailed measures, such as avoiding and buffering site-specific features (e.g., decadent cottonwoods supporting active Lewis' woodpecker nests, etc.), will presumably be developed following site-specific surveys associated with the EIS process. Throughout this section, recognize that (1) mitigation is a less desirable alternative to trail siting that does not avoid certain impacts and (2) that not all mitigation is 100% effective.

8.2.1 Trail Alignment within Existing Disturbance Corridors

For the reasons explained above in Section 8.1, it is a well-founded principal (e.g., Freddy et al. 1986 and Taylor and Knight 2003) that locating a trail (and, most importantly, its associated human activity) within an existing disturbance corridor greatly reduces potential wildlife impacts and minimizes the need for mitigation measures. Applicable mitigation measures and considerations associated with a highway trail alignment include:

1. Because a trail associated with the highway would be located within an existing zone of disturbance and generally affect habitat whose effectiveness has already been diminished by traffic effects and because the road is open year-round, the trail could be open year-round with only insignificant incremental disturbances associated with trail construction and recreational trail use.
2. Engineer and site the trail to protect riparian and wetland habitats flanking the Crystal River, riverbank soils, and water quality. Some impacts to those resources would likely still occur, but they should be minor relative to those associated with any new bridges that would be required to access trail alignments on the east side of the Crystal River and railroad grade upgrading where existing trail sections bisect riparian habitat and are closely associated with thee Crystal River. Depending on bridge locations, some could be located in particularly broad riparian corridors.
3. Public access to the west shoreline of the river should be allowed and designed only where the above resources could be protected adequately.
4. Even if the trail is located along the Highway 133 corridor, west of the river, the current seasonal closures and management policies associated with open space parcels east of the river should be continued to protect the functional values of those critical and important wildlife habitats and ecological communities.
5. Dogs accompanying their owners along the Highway 133 and Redstone Boulevard trail corridors should be leashed.

8.2.2 Seasonal Closures

Seasonal closures are a common management tool used to restrict disturbances to particularly important plants and animals during seasonally sensitive periods of growth and habitat use. For example, rare orchid habitat may be protected during growth, flowering, capsule maturation, and seed dispersal, after which the habitat can be grazed by cattle with little effect to the orchid population. Also, critical big game winter range may be closed to human use during winter, allowing that habitat use to occur without disturbances that would otherwise impair habitat effectiveness.

Because most trail alignments outside of the highway ROW would bisect important and critical wildlife habitats seasonal construction and use closures should be utilized if these trail segments are built. Because, almost without exception, wildlife managers find seasonal closures ineffective, this section is warranted. The author (Thompson) is not a resource manager. However, he has worked with CDOW/ CPW District Wildlife Managers throughout Colorado for 40 years, and he knows their consistent professional opinion that, in general, seasonal closures are not sufficiently effective to protect wildlife habitats. During the March, 2017 field surveys for this assessment, two of the three open space closures that were approached had relatively fresh human tracks entering them.

On paper, seasonal closures appear practical and should work, but to adequately maintain the effectiveness of wildlife habitat they require near 100% compliance. In general, closures are largely

respected, at first, but over time, trail use and non-compliance increases. It takes a relatively small percentage of closure violations and few people to alter wildlife behavior and habitat use. As documented in Section 7.1, even minor, seemingly harmless human disturbances cause elevated heart rates that can result in relatively high energy expenditures (Stemp 1983, Chabot 1991, Canfield et al. 1999), which can lead to habitat avoidance, lowered body weight, increased starvation probabilities, increased susceptibility to predators, and smaller pre-winter body mass of offspring leaving them less fit for overwinter survival. Presently, managers cannot consider the multiple relevant independent variables and predict human disturbance frequency and intensity that would have X effect on wildlife habitat use. Nevertheless, in critical habitats, such violations can have appreciable negative effects. Closures are only as effective as the enforcement that accompanies them. This analysis makes no assumptions concerning how effective Pitkin County or the USFS might be at enforcing any seasonal closures associated with the Crystal Valley Trail. However, in similar critical habitats with seasonal closures around the state, even with enforcement, people still go into closures, go around signs, climb over gates, cut locks, etc. (see Sections 5.6.3 and 5.8). More locally relevant, a December 14, 2003 PCOST memo written by the Pitkin County wildlife biologist about wildlife concerns associated with a conceptual recreation trail crossing Filoha Meadows noted that "seasonal closures are very difficult to enforce." Additionally, the County biologist noted that he, the CDOW DWM (Kevin Wright), and the local USFS wildlife biologist (Phil Nyland) all observed numerous seasonal closure violations on other Crystal River open space parcels (see Section 5.7.2). Over the years, letters from six different CDOW/ CPW wildlife managers (see Sections 5.6 and 5.8) commented on the public's non-compliance with seasonal closures, their limited effectiveness and enforcement, how just a few violations can change and negatively affect big game winter range use, and they cited several examples. Based on the opinions of CDOW personnel the Crystal River Caucus (2007) concluded that trail segments bisecting critical wildlife habitats east of the river could not be justified because of the ineffectiveness of seasonal closures.

Former and current state personnel (Sections 5.6 and 5.8) also identified pragmatic difficulties involved with enforcing seasonal closures. It can be cost prohibitive to have an effective level of closure enforcement. Having enough enforcement to patrol an extensive open space system frequently enough is a considerable commitment. The most effective enforcement requires patrolling closures from dawn until dusk, every day of the week. It is difficult to catch violators on remote trail segments. Game cameras have caught people violating closures, but identifying them was difficult. Enforcement of more remote social trails that may develop elsewhere is even more difficult. They also found it difficult to aggressively enforce and prosecute violations. Courts are often reluctant to prosecute $50.00/ incident closure violations under increased workloads, time constraints of the courts, and higher priority cases when there are no human victims?

Given the distributions of critical and important wildlife habitats in the Crystal River valley and the consistent consensus of wildlife professionals that seasonal closures are often ineffective at protecting those wildlife values, locating multi-use trail segments east of the Crystal River increases the risk that Crystal Trail use will negatively impact wildlife populations. This risk is heightened given the declining status of the local bighorn sheep, mule deer, and elk populations[40].

[40] Over the last 20 years, the local bighorn sheep population has declined by approximately 80% (see Section 6.3.1.2). The local deer population has declined by approximately 46% from the historical objective (Will et al. 2011) in the 1980's and 1990's and is now close to its lowest level in 40 years (see Section 5.8.4). The elk population is stressed (see Section 5.8.4) and below its herd objective with declining calf:cow ratios that will continue that declining population trend (Mao et al. 2013).

8.2.3 Off-highway Trail Segments

The mitigation measures below apply to all off-highway trail segments. Specific recommendations are provided for each trail segment further below.

8.2.3.1 General Recommendations

1. Locate trail segments on the alignments of existing trails (e.g., railroad grade, Hayes Creek bypass trail, and old McClure Pass road switchbacks) to minimize further direct habitat loss and reduced effectiveness of adjacent habitats. Although most of these trail segments are largely unused by humans because of restricted access, wildlife use of the bisected habitats will have already been altered somewhat by current seasonal levels of human use.

2. Limit trail construction (i.e., implement seasonal trail construction closures) bisecting critical and important wildlife habitats outside of the use periods identified by CPW (see Sections 6.3 and 10.2).

3. Implement and enforce seasonal trail use closures through critical and important wildlife habitats during periods of wildlife use, as identified by CPW. As described in Section 8.2.2, above, it is the consensus of wildlife professionals that seasonal closures will not be sufficiently effective to protect the wildlife values and there likely will be appreciable negative impacts resulting from trail use violations. Regardless of their efficacy, seasonal closures would be better than no closures. Specific closure periods are provided under individual trail sections. Seasonal closures should include:

   (a) A commitment in perpetuity by Pitkin County to fund and implement a level of seasonal closure enforcement that CPW considers sufficient to protect the target wildlife resources.

   (b) A commitment in perpetuity by Pitkin County to regularly survey all Crystal River trail segments to identify and promptly close social trails that develop on public and private lands as a result of new public access to those lands east of the Crystal River.

   (c) A commitment in perpetuity by Pitkin County to work with CPW to develop and implement adaptive management to resolve seasonal closure violations. Include in the adaptive management plan the ability to completely close the trail if seasonal closures are ineffective and not being complied with.

   (d) Install locked gates with restrictive fencing and signage on all access points to trail segments with seasonal closures to restrict and educate the public (e.g., what the closure period is, why the area is closed, penalties for violations, etc.). It is recommended that closure gates be installed on the west side or at the mid-span of any new bridges crossing the river and that gates and peripheral fencing be designed to effectively thwart access. Access across the two potential new bridges to the potential CROS trail segment could be effectively restricted with gated fencing,[41]

[41] Recognizing that the author is not an engineer.

although there may be some conflict with the highway's scenic status. Physically blocking committed user access to the RWP and J&F trail segments during the seasonal closures would be ineffective because of existing bridge and road access.

(e) Identify additional seasonal construction and use closures that might be needed to protect site-specific, plant, aquatic, animal, and habitat issues identified during EIS baseline surveys.

4. Prohibit all dogs on off-highway trail segments. Dogs on leashes generally present few conflicts with wildlife, but the compliance rate of dogs on leashes is generally very low.

5. Develop and maintain educational materials at trail access points. Some key issues to include are:

   (a) The biological needs for seasonal trail closures along the Crystal River trail.
   (b) That the trail bisects important wildlife habitats.
   (c) Users are required to stay on trails.
   (d) Users should be discouraged from approaching wildlife (do not approach big game closer than 100 yards) that causes them to become alert (and stop foraging) or flee (increasing energetic expenditures).
   (e) Recreationists should be aware of wildlife responses, such as alert distances, flight distances, the distances they may flee, increased stress levels, lost foraging opportunities, lost energy reserves, reduced survivorship, the possibility for reduced carrying capacity of public lands, and the fact that each additional user may have a small yet cumulative impact on the environment.
   (f) Maintain the educational material on the county's website and provide newspaper materials in advance of seasonal closure periods.

6. Consider increasing the penalty for seasonal closure violators to something that would change human behavior and encourage compliance.

8.2.3.2 Crystal River Open Space Segment

1. Construction Closures
   (a) A December 1st through March 31st construction closure of the entire CROS trail segment would be warranted because the entire trail segment would be located close to (within ¼ mile of) sheep winter range and the entire alignment would bisect elk and mule deer winter range.

2. Seasonal Trail Closures
   (a) The CROS trail segment would bisect elk and deer winter range. Development in Pitkin County has not been required to avoid such habitats, nor have trails through such habitats been closed to protect habitat values. However, trail closures through such spatially limited habitats are warranted biologically, particularly if the level of winter trail use could approach that of a high impact recreational use. Such a

seasonal trail closure to protect winter range should extend from December 1st through March 31st.

(b) Access across the two new bridges to the potential CROS trail segment could be effectively restricted with gated fencing, although there may be some conflict with the highway's scenic status.

8.2.3.3 Red Wind Point Segment

1. Construction Closures
   (a) A December 1st through March 31st construction closure of the entire RWP trail segment would be warranted because the entire alignment would bisect elk winter range and the entire trail segment would be located within ¼ mile of sheep winter range.

   (b) A May 15th through June 30th construction closure of the entire RWP trail segment would be warranted because the entire trail segment would be located within ¼ mile of a sheep production area.

2. Seasonal Trail Closures
   (a) Portions of the RWP trail segment would bisect a bighorn sheep winter concentration area (a critical habitat), and come within ¼ mile of severe winter range (a critical habitat) and sheep lambing polygons. Seasonal trail closures warranted to protect these habitats should extend from December 1st through March 31st to protect winter range and May 15th through June 30th to protect sheep lambing habitat.

8.2.3.4 Janeway and Filoha Meadows Segment

1. Construction Closures
   (a) A December 1st through March 31st construction closure of the entire J&F trail segment north of Redstone Boulevard would be warranted because that segment would (1) bisect or be located within ¼ mile of sheep winter range, (2) the entire alignment would bisect elk winter range, (3) portions of the alignment through Janeway Flats, Avalanche Creek, and Filoha Meadows would bisect and come within ¼ mile of elk winter concentration area (a critical habitat), and (4) portions of the alignment through Avalanche Creek would bisect and come within ¼ mile of elk severe winter range (a critical habitat).

   (b) October 15th through November 30th and April 15th through May 30th construction closures of the J&F trail segment in the vicinity of The Narrows would be warranted to protect the bighorn sheep migration corridor.

   (c) A May 15th through June 30th construction closure of the J&F trail segments in the vicinity of Avalanche Creek and Filoha Meadows would be warranted to protect those two sheep production areas.

(d) In summary, construction closures to avoid critical and sensitive sheep habitats would allow construction of the J&F trail segment to occur from July 1 to October 14.

1. Seasonal Trail Closures
   (a) Portions of the J&F trail segment would come within ¼ mile of bighorn sheep winter concentration area (a critical habitat), severe winter range (a critical habitat), and sheep lambing polygons. Seasonal trail closures warranted to protect these habitats should extend from December 1st through March 31st to protect winter range and May 15th through June 30th to protect sheep lambing habitat.

   (b) Portions of the J&F trail segment would bisect and come within ¼ mile of elk winter concentration area (a critical habitat) and severe winter range (a critical habitat). Seasonal trail closures warranted to protect these habitats should extend from December 1st through March 31st.

2. Other Mitigation
   (a) North of Avalanche Creek Road and south of Janeway flats, there is a ridge that drops steeply down to the Crystal River. The railroad grade cut through the toe of this ridge. The ridge sloughs boulders, cobble, and soil onto the old grade. It is unknown if this site warrants geologic hazard status or if the bypass identified in Newland (2004) over the saddle into Avalanche Creek was to avoid private lands. However, the potential trail segment identified in Newland (2004) avoids the old railroad grade. A trail segment following the old railroad grade around the point, reinforced with a retaining wall or other engineering, would keep the trail out of bighorn sheep winter range, along the existing Avalanche Creek Road, away from the bypass's close (approx. 171 ft.) approach to bighorn winter concentration area and SWR polygons, and avoid creating a new disturbance corridor.

8.2.3.5 Hayes Creek Canyon Bypass

1. Construction and Seasonal Trail Closures
   (a) The potential Hayes Creek Canyon bypass bisects elk winter range that would be better protected with December 1st through March 31st construction and seasonal use closures. This trail segment on NFS land would also be governed by the WRNF Forest Plan, Forest-wide, Wildlife Standards 8 and 9 related to peregrine falcons (see Section 6.3.5). If this trail segment is rationalized and approved (requiring a Forest Plan Amendment explaining the Selected Alternative's inconsistency with Standard 8, it would be consistent with Standard 9 if human activities were restricted within one-half mile of the occupied peregrine falcon eyrie between March 15 and July 31. The early part of the nesting period is most sensitive.

8.2.3.6 Old McClure Pass Road Switchbacks

1. Construction Closures
   (a) A December 1st through March 31st construction closure of the lower one-half of the old McClure Pass Road switchbacks would be warranted because it bisects elk winter range.

2. Seasonal Trail Closures
    (a) The old McClure Pass Road switchbacks bisect elk winter range that would be best protected with a December 1st through March 31st seasonal use closure.

3. Other Mitigation
    (a) Hiker, snowshoer, and Nordic use of the old McClure Pass Road switchbacks is largely governed by parking availability. If desired, those uses could be reduced for the benefit of wildlife (e.g., wintering elk, breeding birds, and other mapped wildlife) by the removal of the small defacto parking area near the base. Conversely, expanded parking would increase on-foot use and increase the seasonal displacement of wildlife.

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10.0 APPENDICES

10.1 PCOST AERIAL PHOTOGRAPHIC MAPPING OF THE CRYSTAL RIVER TRAIL CORRIDOR

Aerial photographic mapping of the Crystal River Trail corridor that was developed by PCOST for their January, 2017 public open house meetings is provided in Figures 11-1 to 11-10, below. These maps show greater detail of corridor sections than the larger scale wildlife mapping. Map index as follows.

Figure 10.1-1. Crystal Valley Map A-1, 7 Oaks, Crystal River Parcel 1, and Nettle Creek.

Figure 10.1-2. Crystal Valley Map A-2, Red Wind Point, Crystal River Country Estates.

Figure 10.1-3. Crystal Valley Map A-3, Andrews, Meredith, Janeway.

Figure 10.1-4. Crystal Valley Map A-4, Janeway, Avalanche.

Figure 10.1-5. Crystal Valley Map A-5, Filoha, Wild Rose.

Figure 10.1-6. Crystal Valley Map A-6, Wild Rose, Redstone.

Figure 10.1-7. Crystal Valley Map A-7, Redstone, Castle.

Figure 10.1-8. Crystal Valley Map A-8, Castle, Hayes Falls, Bear Creek.

Figure 10.1-9. Crystal Valley Map A-9, Bear Creek, McClure Pass.

Figure 10.1-10. Crystal Valley Map A-10, McClure Pass.

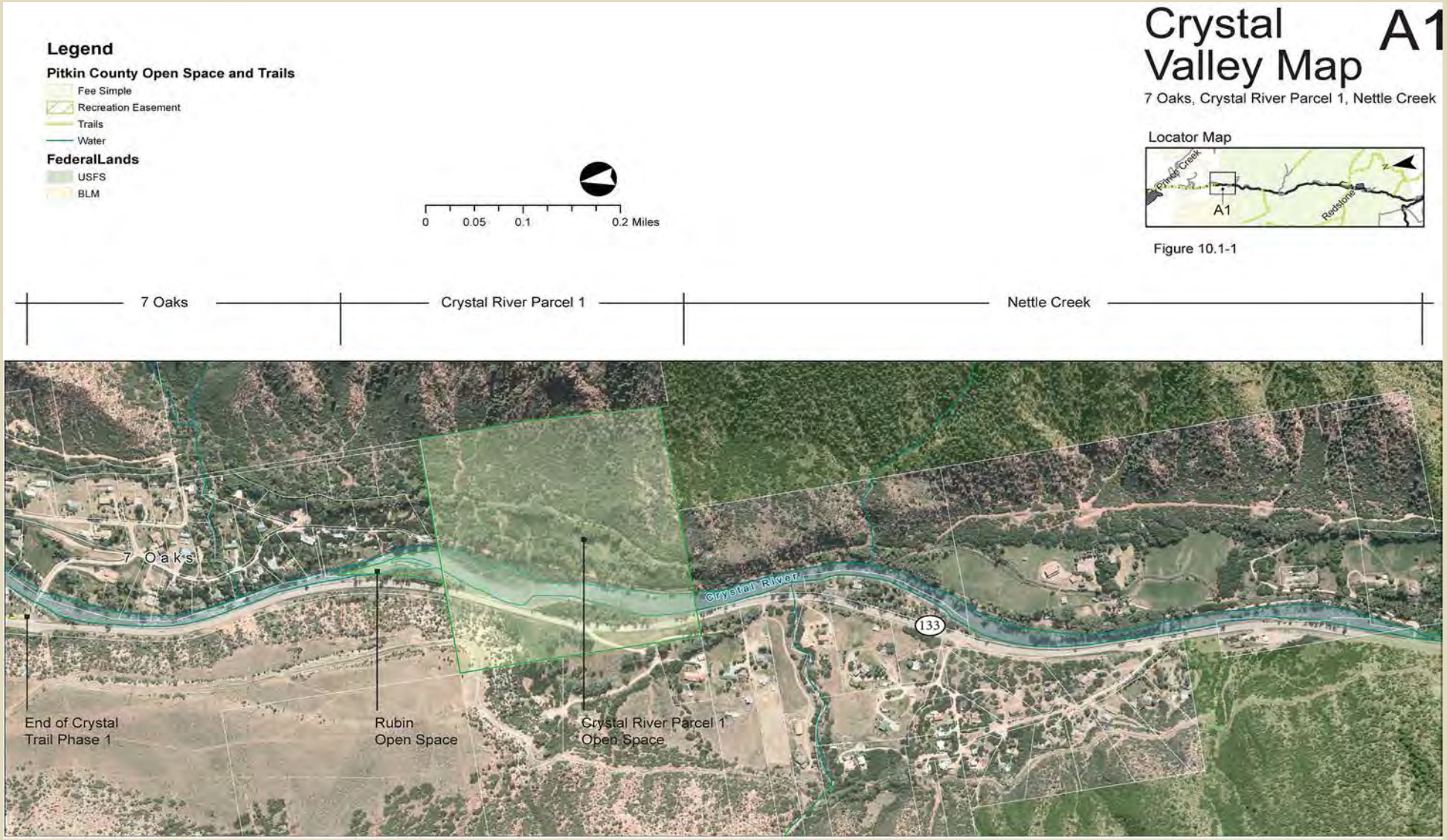

Figure 10.1-1. Crystal Valley Map A-1, 7 Oaks, Crystal River Parcel 1, and Nettle Creek.

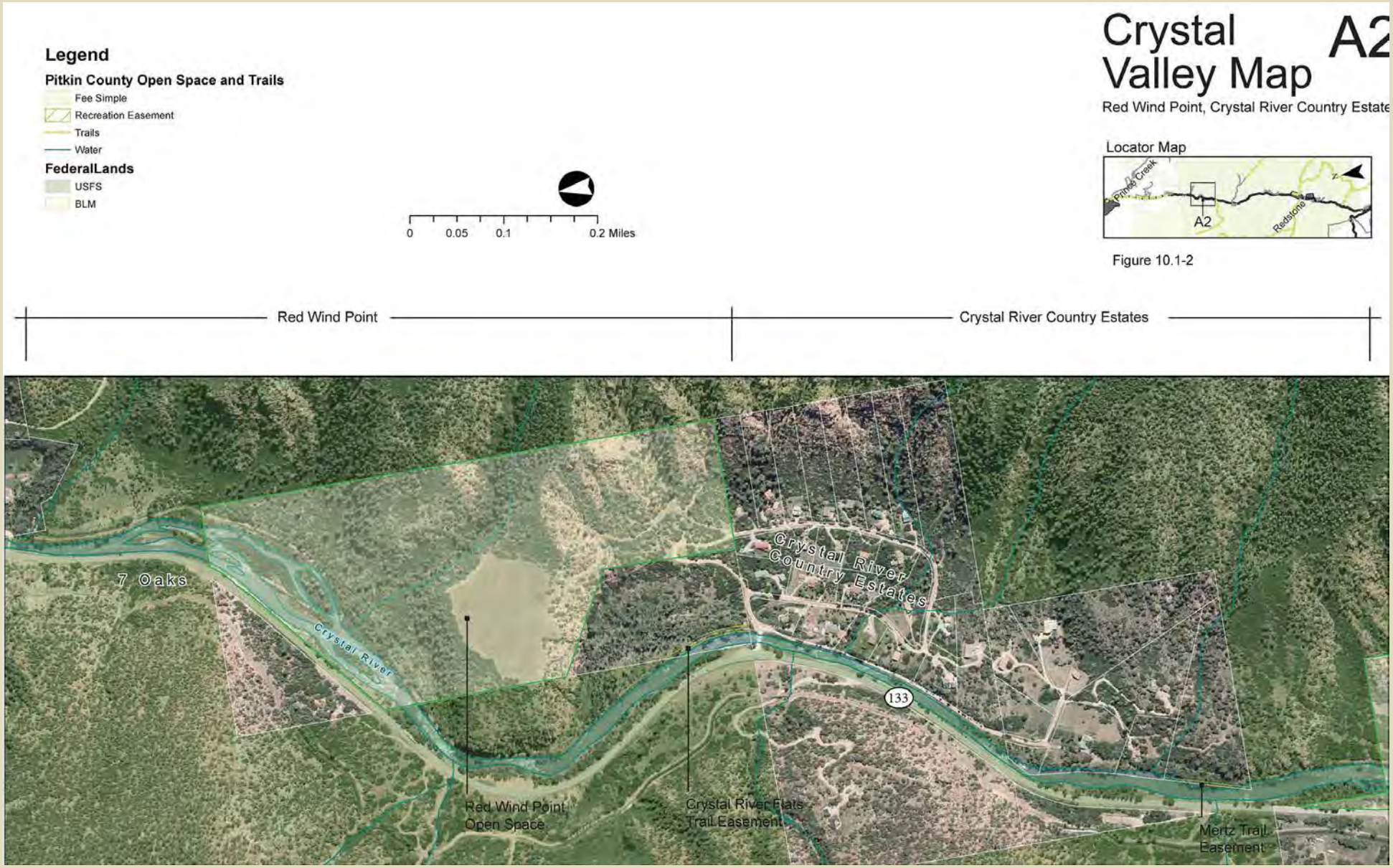

Figure 10.1-2. Crystal Valley Map A-2, Red Wind Point, Crystal River Country Estates.

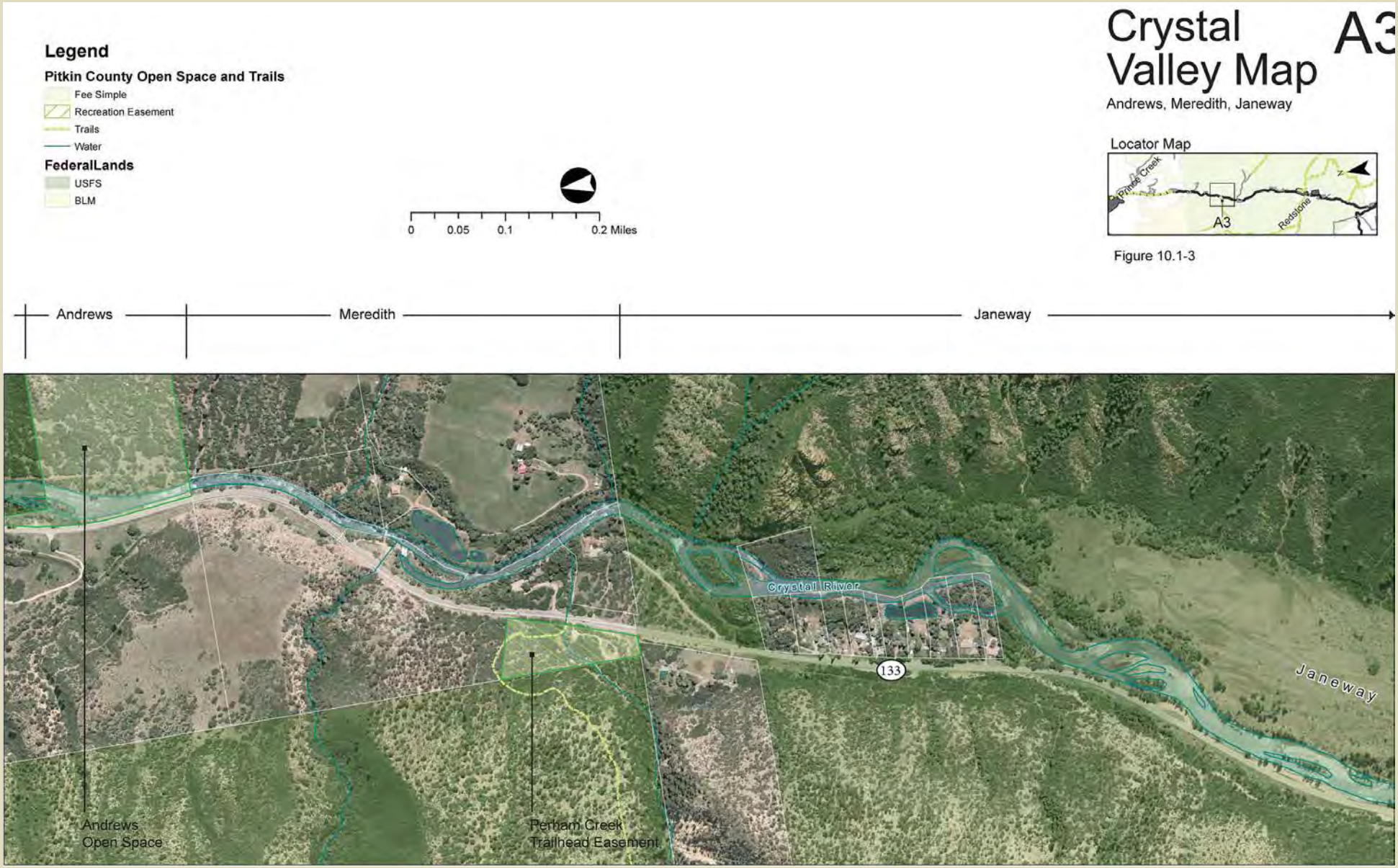

Figure 10.1-3. Crystal Valley Map A-3, Andrews, Meredith, Janeway.

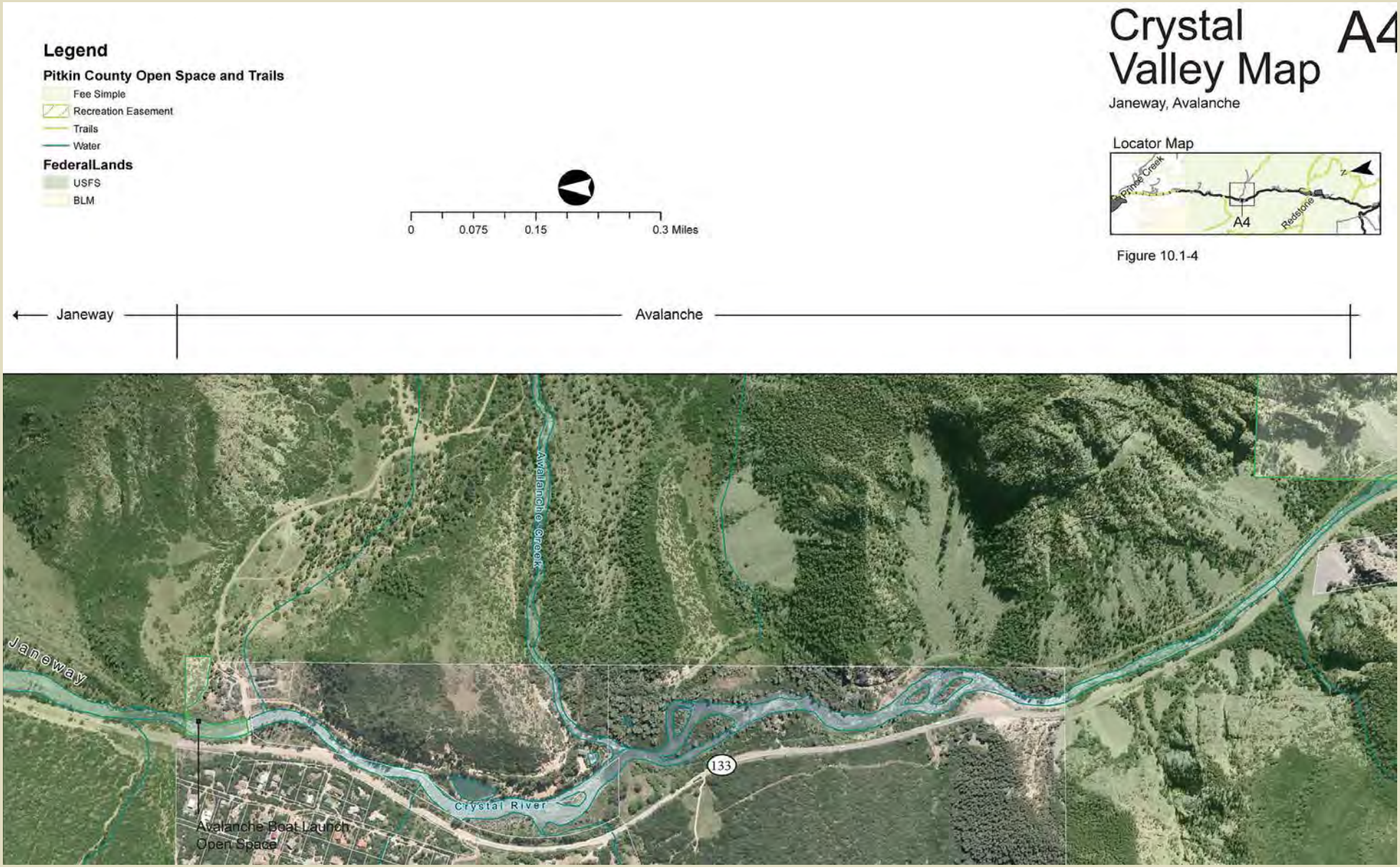

Figure 10.1-4. Crystal Valley Map A-4, Janeway, Avalanche.

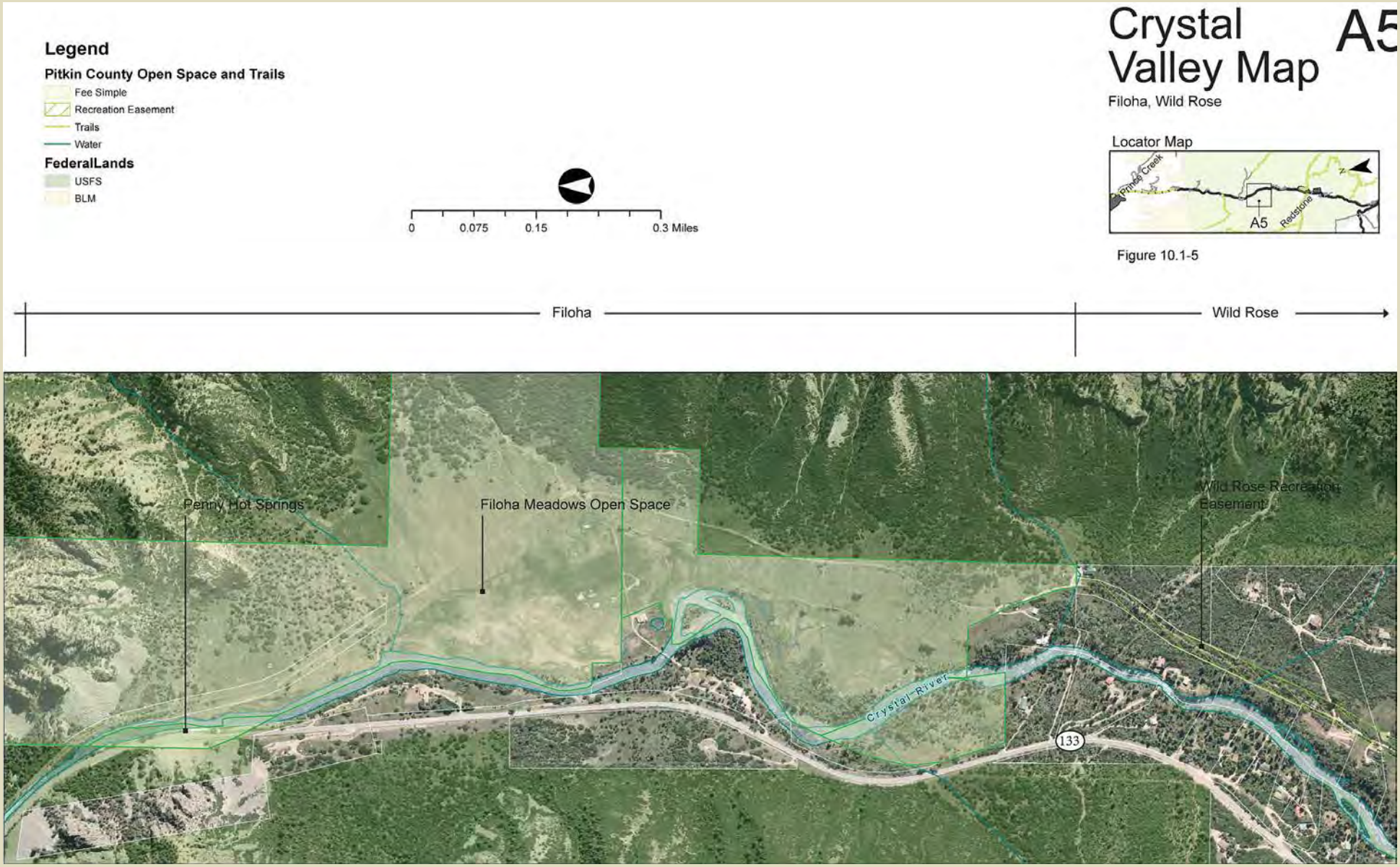

Figure 10.1-5. Crystal Valley Map A-5, Filoha, Wild Rose.

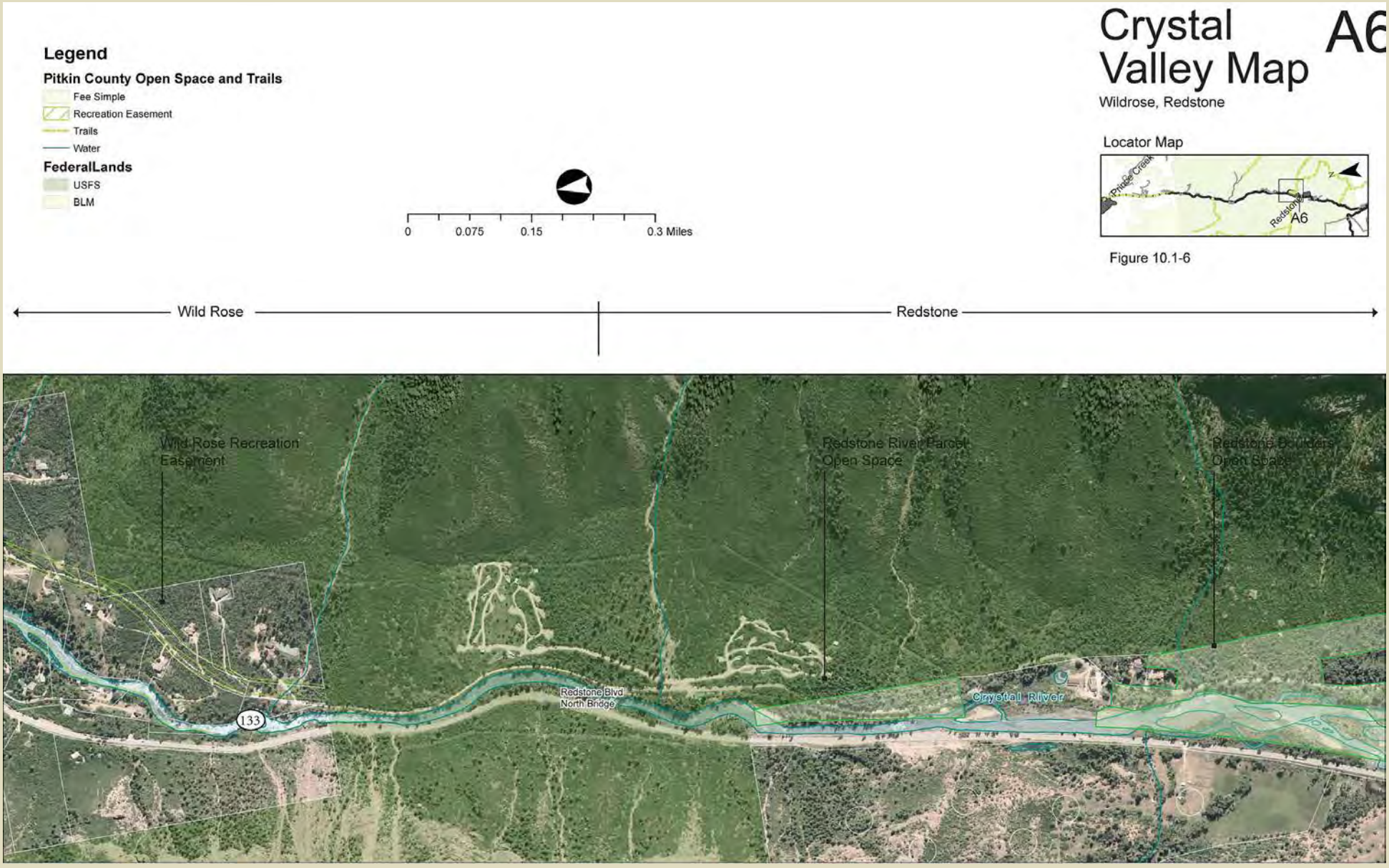

Figure 10.1-6. Crystal Valley Map A-6, Wild Rose, Redstone.

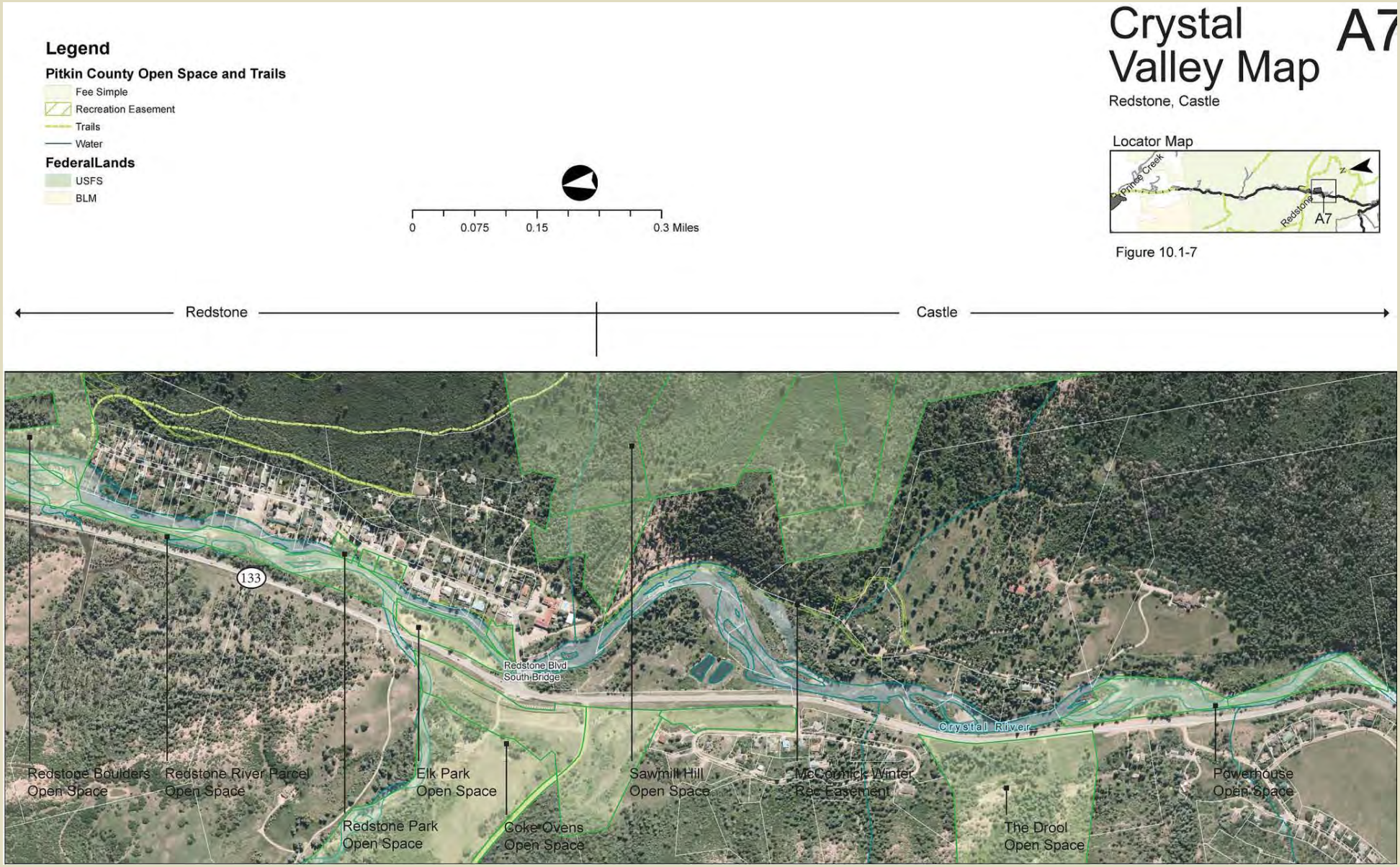

Figure 10.1-7. Crystal Valley Map A-7, Redstone, Castle.

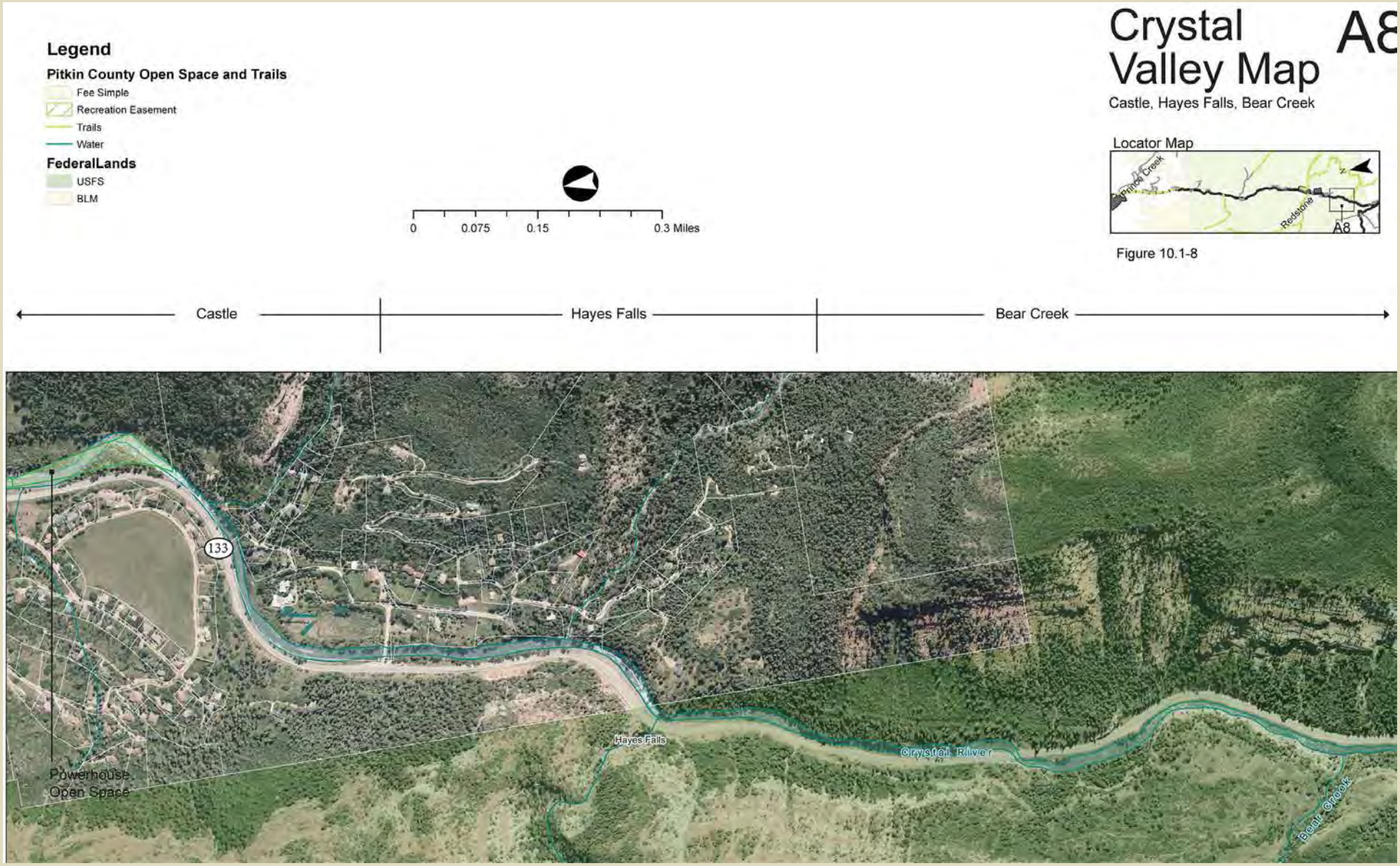

Figure 10.1-8. Crystal Valley Map A-8, Castle, Hayes Falls, Bear Creek.

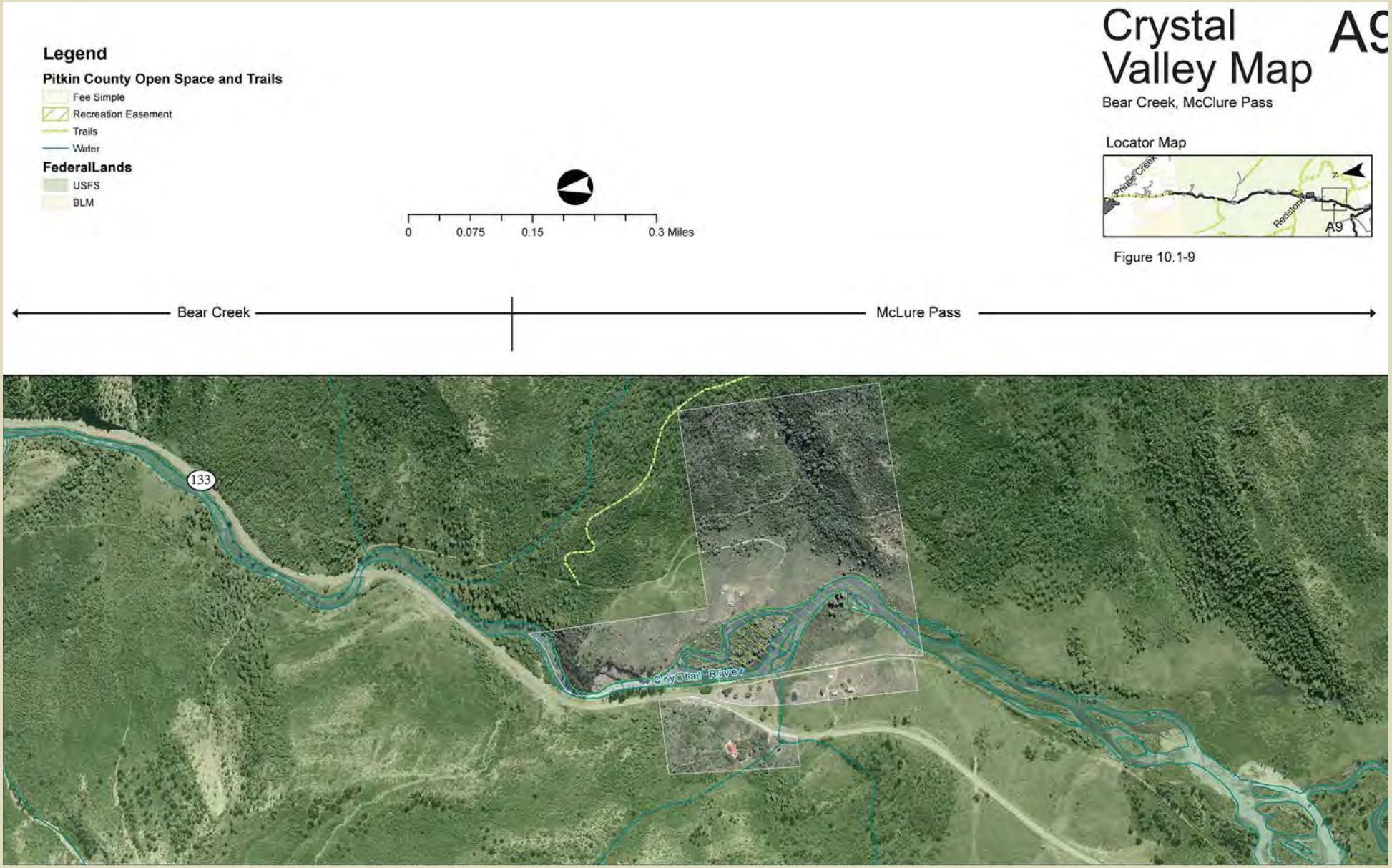

Figure 10.1-9. Crystal Valley Map A-9, Bear Creek, McClure Pass.

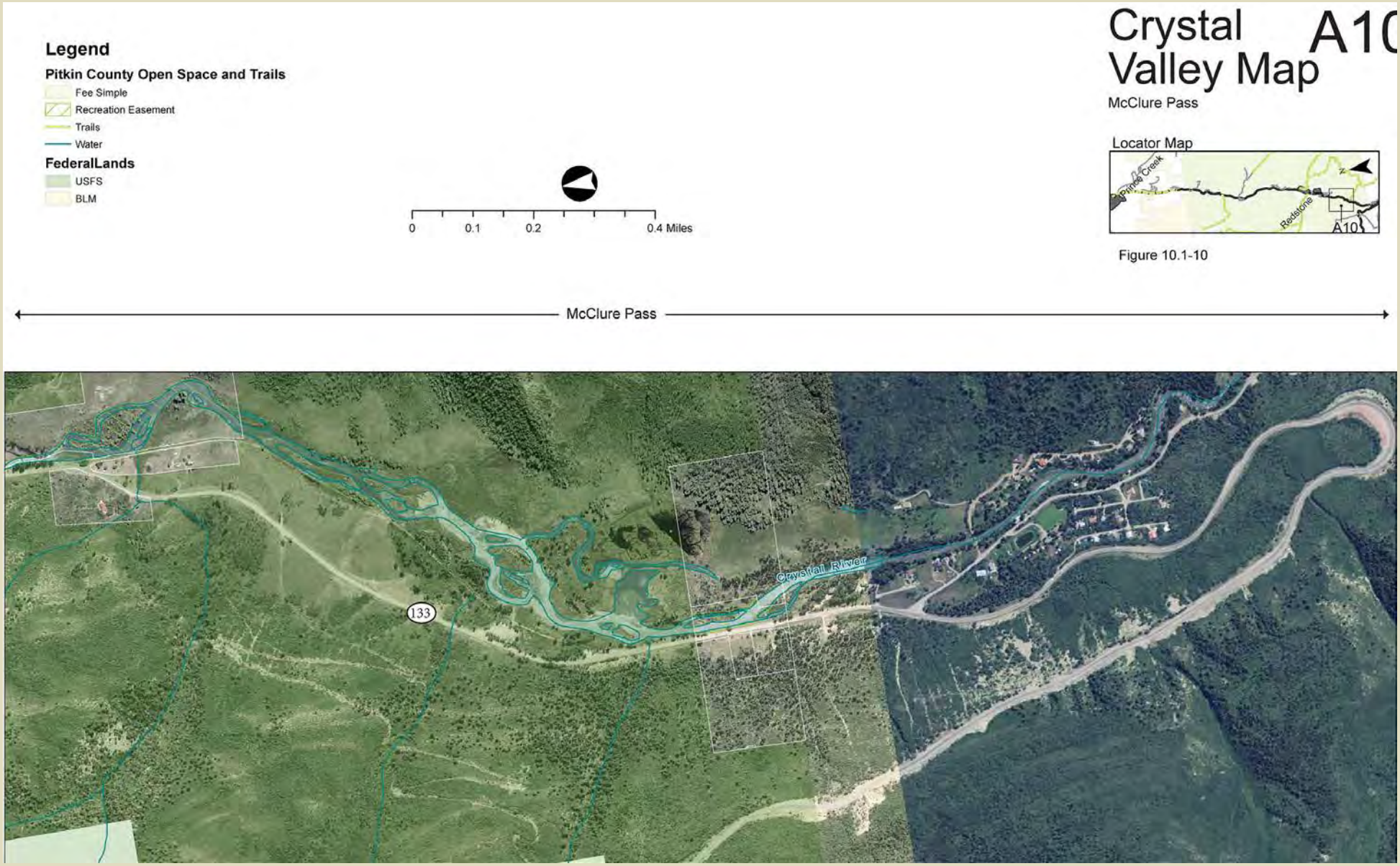

Figure 10.1-10. Crystal Valley Map A-10, McClure Pass.

10.2 COLORADO PARKS AND WILDLIFE SEASONAL WILDLIFE ACTIVITY AREA DEFINITIONS

The following wildlife species have seasonal ranges overlapping proposed Crystal River Trail corridor sections B and C. Seasonal activity area definitions and use dates, below, are those obtained from the CPW website and are applicable generally statewide. Some dates were defined more accurately for the local Data Analysis Units (i.e., the local management areas) by the local DWM (J. Groves, pers. comm., Mar. 27, 2017) and the Terrestrial Biologist, per CPW direction. Other use periods are provided based on anecdotal observations by identified knowledgeable parties.

Species are listed in declining order of significant potential trail effects along the bottom of the Crystal River Valley. Bighorn sheep and elk are the species of particular concern. The order of the remaining species is somewhat arbitrary. Other habitats of these CPW-mapped species may also be affected outside of the Crystal River valley bottom.

10.2.1 Rocky Mountain Bighorn Sheep

Migration Corridor: A specific mappable site through which large numbers of animals migrate and loss of which would change migration routes. Overall sheep use of the local corridor through The Narrows occurs from November 15 to May 1, with ram use extending from November 15 to December 31, all dates inclusive.

Migration Patterns: A subjective indication of the general direction taken by migratory ungulate herds.

Mineral Lick – Specific natural sites known to be utilized by bighorn sheep for obtaining minerals to meet basic nutritional needs. The use period is not specified by CPW data. Lick use typically starts mid-June, peaks the first week of July, then tapers off asymptotically, depending upon how much socialization is involved (e.g., Thompson 1981). Local use of the licks has been observed as late as mid-August. Radio-collar data have shown extended movements over a several days from high summer range, down to the mineral licks, and back to the high summer range.

Production area: That part of the overall range of bighorn sheep occupied by pregnant females during a specific period of spring. This period is May 1 to June 30 for Rocky Mountain bighorn sheep.

Severe Winter Range: That part of the overall range where 90% of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten.

Summer Concentration Area: Those areas where bighorn sheep concentrate from mid-June through mid-August. High quality forage, security, and lack of disturbance may be characteristic of these areas to meet the high energy demands of lactation, calf rearing, antler growth, and general preparation for the rigors of fall and winter.

Summer Range: That part of the overall range where 90% of the individuals are located between spring green-up and the first heavy snowfall. Summer range is not necessarily exclusive of winter range; in some areas winter range and summer range may overlap.

Water Source: Water sources known to be utilized by bighorn sheep in dry, water scarce areas. Up to a 1.6 km radius should be described around a point source, and up to a 1.6 km band be drawn along a river or stream.

Winter Concentration Area: That part of the winter range where densities are at least 200% greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of ten.

Winter Range: That part of the overall range where 90 percent of the individuals are located during the average five winters out of ten from the first heavy snowfall to spring green-up, December 1 to April 30, dates inclusive, for this DAU.

10.2.2 Elk

Highway Crossing: Those areas where elk movements traditionally cross roads, presenting potential conflicts between elk and motorists.

Limited Use Area: An area within the overall range which is occasionally inhabited by elk and/or contains a small scattered population of elk.

Migration Corridor: A specific mappable site through which large numbers of animals migrate, the loss of which would change migration routes. Local use of this corridor has been defined as October 15 to November 30 and April 15 to May 30, all dates inclusive.

Migration Patterns: A subjective indication of the general direction taken by migratory ungulate herds.

Overall Range: The area which encompasses all known seasonal activity areas within the observed range of an elk population.

Production Area: That part of the overall range of elk occupied by the females from May 15 to June 15 for calving, (May 15 to June 21 as currently applied in the Pitkin County Code). Based on the Vail elk study (Phillips [1998] and Phillips and Alldredge [2000]), May 1 to July 1 would be a more biologically conservative closure period, allowing cows to select optimal calving sites, accommodating early and late calves, and including initial elk rearing when calves develop physically to where they can travel with their cow. Only known areas are mapped and this does not include all production areas for the DAU.

Resident Population: An area used year-round by a population of elk. Individuals could be found in any part of the area at any time of the year; the area cannot be subdivided into seasonal ranges. It is most likely included within the overall range of the larger population.

Severe Winter Range: That part of the range of a species where 90 percent of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten. The winter of 1983-84 is a good example of a severe winter.

Summer Concentration Area: Those areas where elk concentrate from mid-June through mid-August. High quality forage, security, and lack of disturbance are characteristics of these areas to meet the high energy demands of lactation, calf rearing, antler growth, and general preparation for the rigors of fall and winter.

Summer Range: That part of the range of a species where 90% of the individuals are located between spring green-up and the first heavy snowfall, or during a site-specific period of summer as defined for each

DAU. Summer range is not necessarily exclusive of winter range; in some areas winter range and summer range may overlap.

Winter Concentration Area: That part of the winter range of a species where densities are at least 200% greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of ten.

Winter Range: That part of the overall range of elk where 90% of the individuals are located during the average five winters out of ten from the first heavy snowfall to spring green-up, December 1 to April 1, dates inclusive, for this DAU.

10.2.3 Mule Deer

Concentration Area: That part of the overall range where higher quality habitat supports significantly higher densities than surrounding areas. These areas are typically occupied year round and are not necessarily associated with a specific season. Includes rough break country, riparian areas, small drainages, and large areas of irrigated cropland.

Highway Crossing: Those areas where mule deer movements traditionally cross roads, presenting potential conflicts between mule deer and motorists.

Limited Use Area: An area within the overall range of mule deer that is only occasionally inhabited and/or contains only a small population of scattered mule deer.

Migration Corridors: A specific mappable site through which large numbers of animals migrate and loss of which would change migration routes.

Migration Patterns: A subjective indication of the general direction taken by migratory ungulate herds.

Overall Range: The area that encompasses all known seasonal activity areas within the observed range of a mule deer population.

Resident Population: An area that provides year-round range for a population of mule deer. The resident mule deer use all of the area all year; it cannot be subdivided into seasonal ranges although it may be included within the overall range of the larger population.

Severe Winter Range: That part of the overall range where 90% of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten.

Summer Range: That part of the overall range where 90% of the individuals are located between spring green-up and the first heavy snowfall. Summer range is not necessarily exclusive of winter range; in some areas winter range and summer range may overlap.

Winter Concentration Area: That part of the winter range where densities are at least 200% greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of ten.

Winter Range: That part of the overall range where 90% of the individuals are located during the average five winters out of ten from the first heavy snowfall to spring green-up, or during a site specific period of winter, December 1 to April 30, dates inclusive, for this DAU.

10.2.4 Bald Eagle

Winter Range: Winter range is defined as those areas where bald eagles have been observed between November 15 and April 1.

Winter Foraging Area: Winter foraging areas are defined as areas frequented by wintering bald eagles between November 15 and March 15.

10.2.5 Peregrine Falcon

Nesting Area: Nesting area is defined as an area that includes good nesting sites and contains one or more active or inactive nest locations. The boundaries are drawn based on professional judgment to include most known nesting habitat in the vicinity. Usually these areas are mapped as polygons around cliffs and include a 0.5 mile buffer surrounding the cliffs. The specific nesting use period was not provided by CPW. According to Jerry Craig, the former CDOW Raptor Biologist (ret.), eggs are laid as early as April 15, young hatch mid- to late May, and fledge in mid- to late June (Craig 1978). So, the most important nesting period would be April 15-June 30. This does not include courtship or post-fledging use of the area.

Potential Nesting Area: Potential nesting is defined as an area which appears to include the necessary components for peregrine falcon nesting, but in which no known active or inactive nest sites are present.

10.2.6 Black Bear

Fall Concentration Area: Fall concentration areas are defined as those parts of the overall range that are occupied from August 15 until September 30 for the purpose of ingesting large quantities of mast and berries to establish fat reserves for the winter hibernation period.

Human Conflict Area: Human/bear conflict areas are defined as that portion of the overall range where two or more confirmed black bear complaints per season were received which resulted in CPW investigation, damage to persons or property (cabins, tents, vehicles, etc.), and/or the removal of the problem bear(s). This does not include damage caused by bears to livestock.

10.2.7 Moose

Concentration Area: That part of the range of a species where densities are 200% higher than the surrounding area during a specific season. This definition is vague. Ungulate concentration areas are usually specified as summer or winter.

Winter Range: That part of the overall range where 90% of the individuals are located during the winter months, November 15 to April 1.

10.2.8 Wild Turkey

Winter Range: Defined as that part of the overall range where 90% of the individuals are located from November 1 to April 1 during the average five winters out of ten.

10.3 COLORADO PARKS AND WILDLIFE-MAPPED SPECIES

Eight[42] wildlife species mapped by CPW have seasonal ranges overlapping proposed Crystal River Trail corridor sections B and C. Activity area definitions and seasonal use dates are described above in Section Appendix 10.2. The bighorn sheep (Figs. 10.3-1 to 10.3.3), elk (Figs. 10.3-4 to 10.3.6), and peregrine falcon (Fig. 10.3-15) figures show buffer zones and setbacks that have been used in Pitkin County to avoid critical and other important wildlife habitats. Map index as follows.

[42] Other wildlife species (e.g., mountain goat and lynx) mapped by CPW have seasonal ranges overlapping portions of the Crystal River watershed, but they are not focal species of concern on this project.

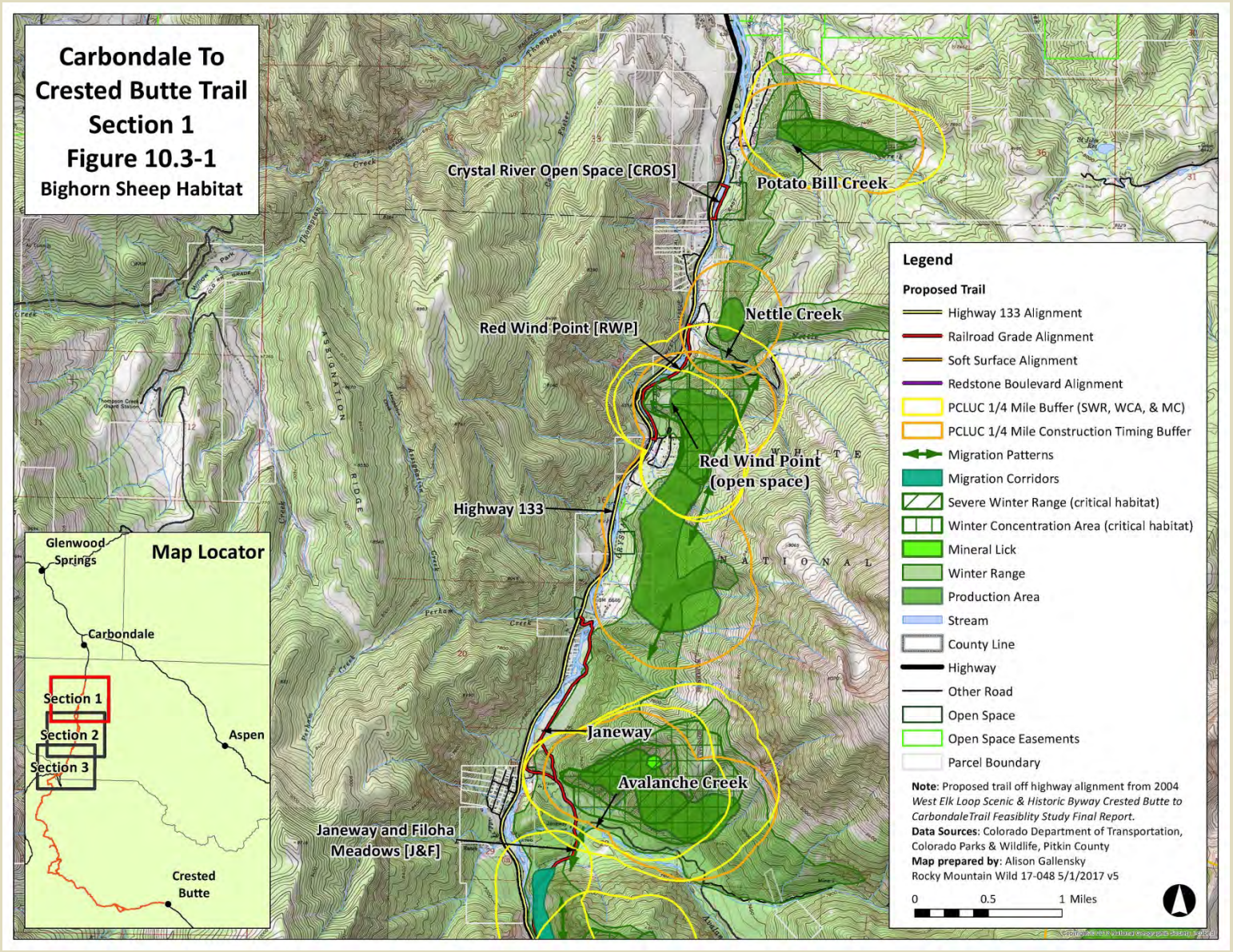

Figure 10.3-1. Bighorn Sheep, Crystal Valley Trail Section 1, Potato Bill Creek to Avalanche Creek

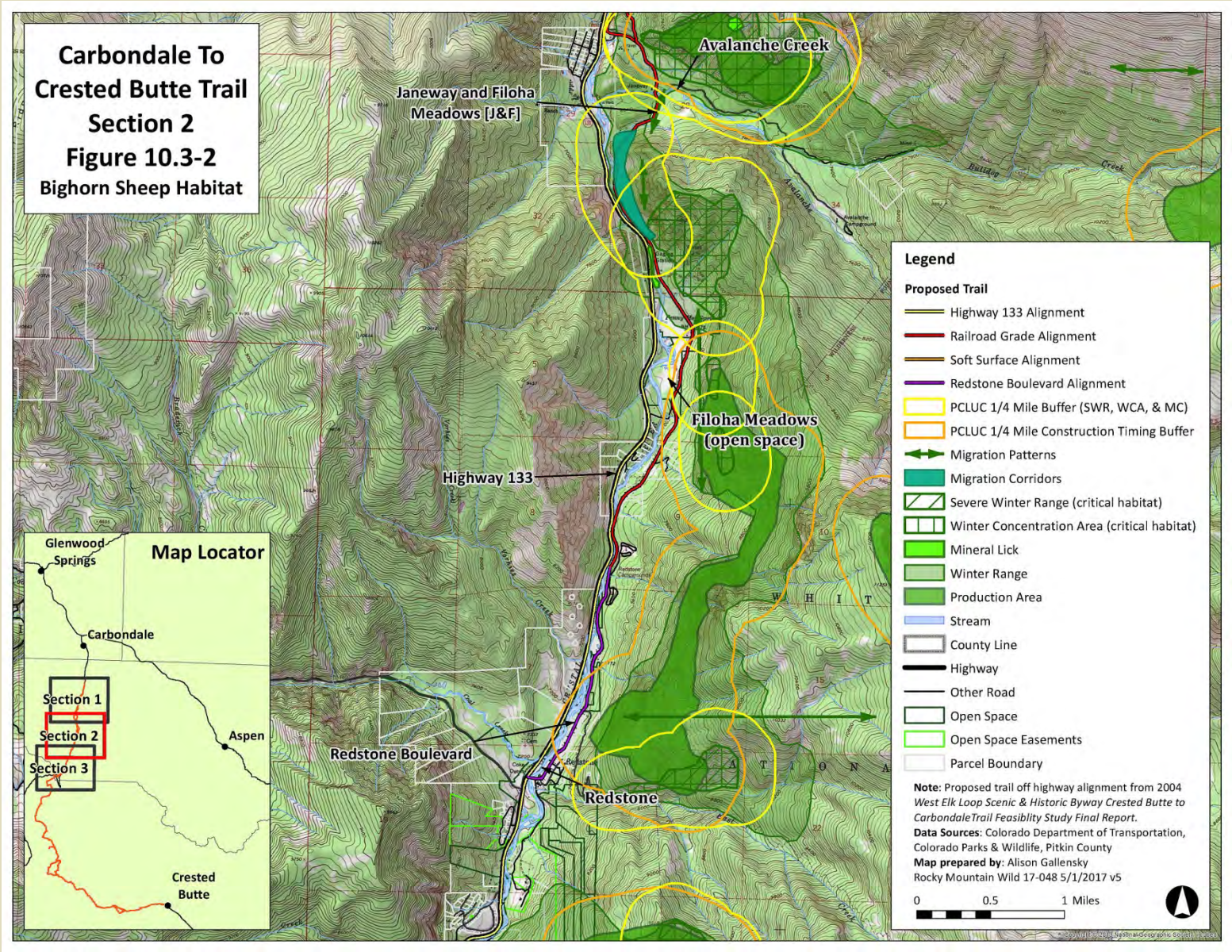

Figure 10.3-2. Bighorn Sheep, Crystal Valley Trail Section 2, Avalanche Creek to Redstone

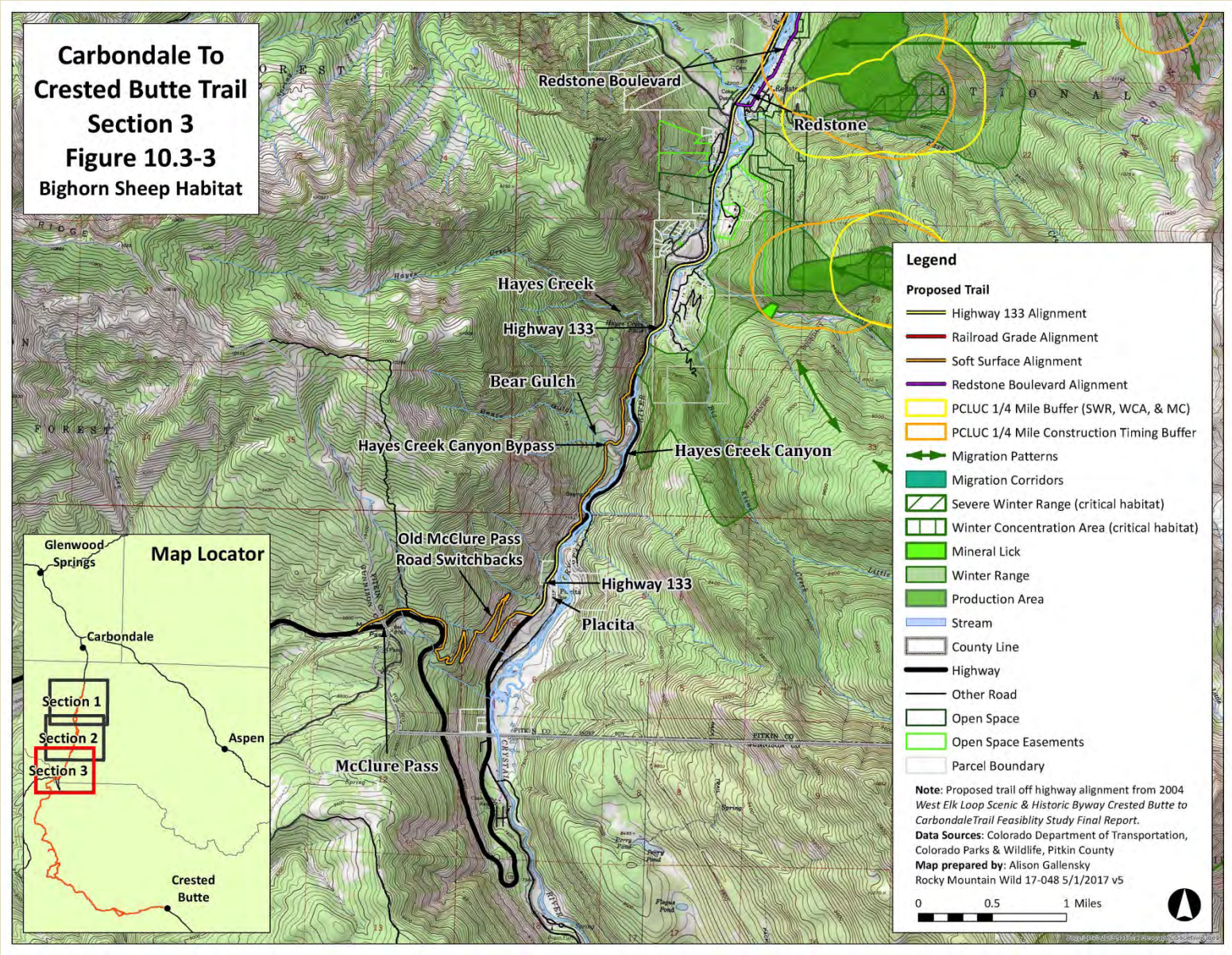

Figure 10.3-3. Bighorn Sheep, Crystal Valley Trail Section 3, Redstone to McClure Pass

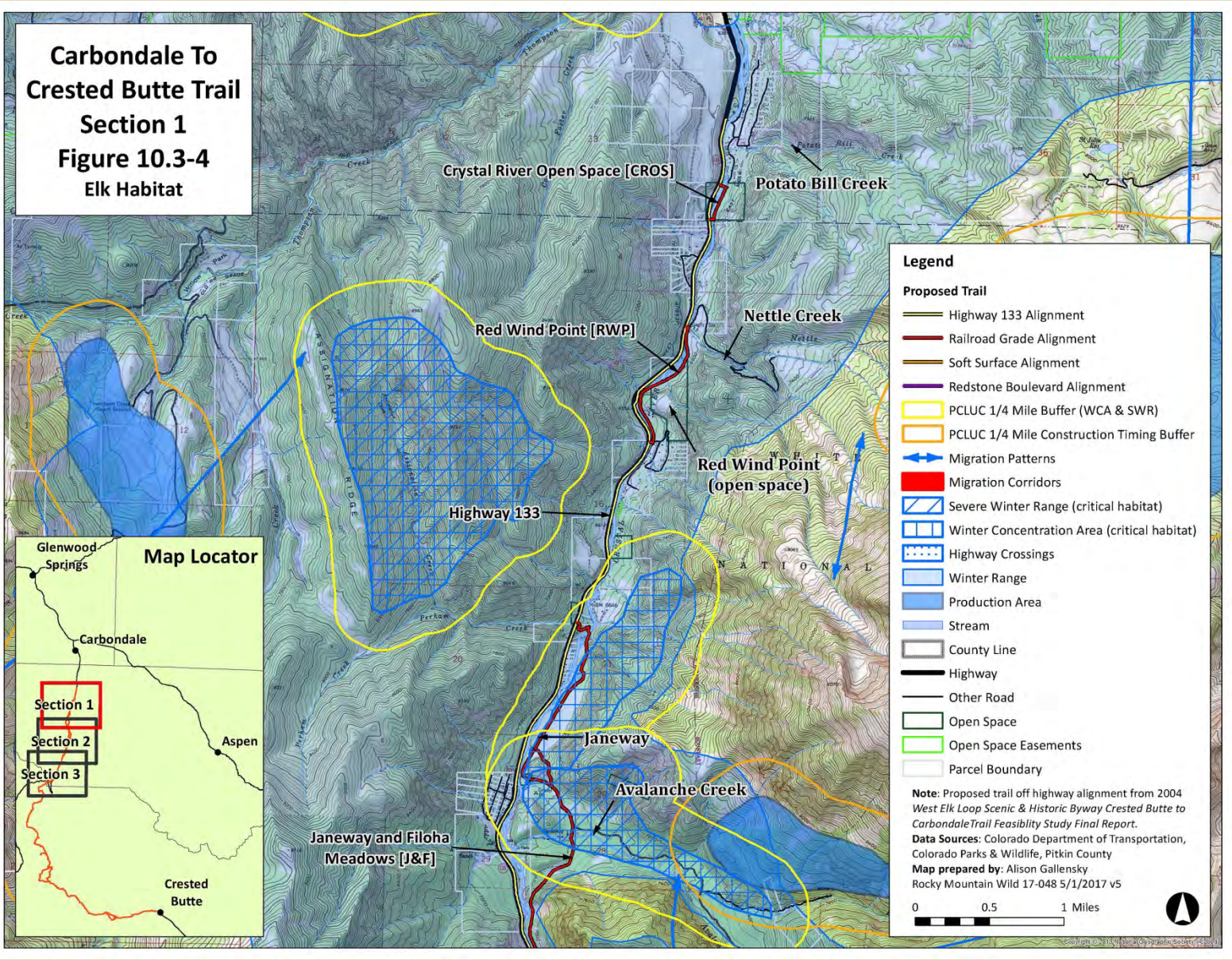

Figure 10.3-4. Elk, Crystal Valley Trail Section 1, Potato Bill Creek to Avalanche Creek

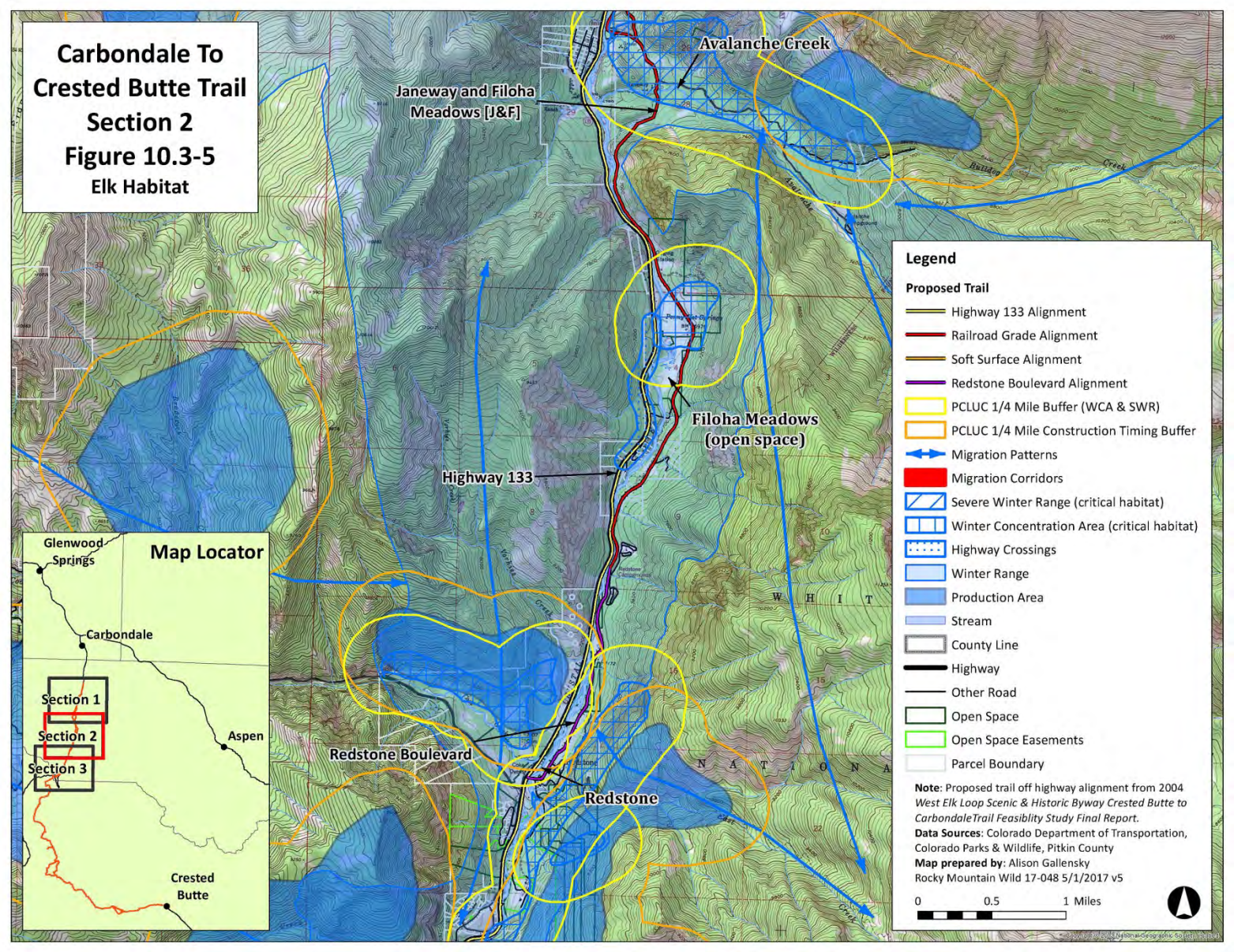

Figure 10.3-5. Elk, Crystal Valley Trail Section 2, Avalanche Creek to Redstone

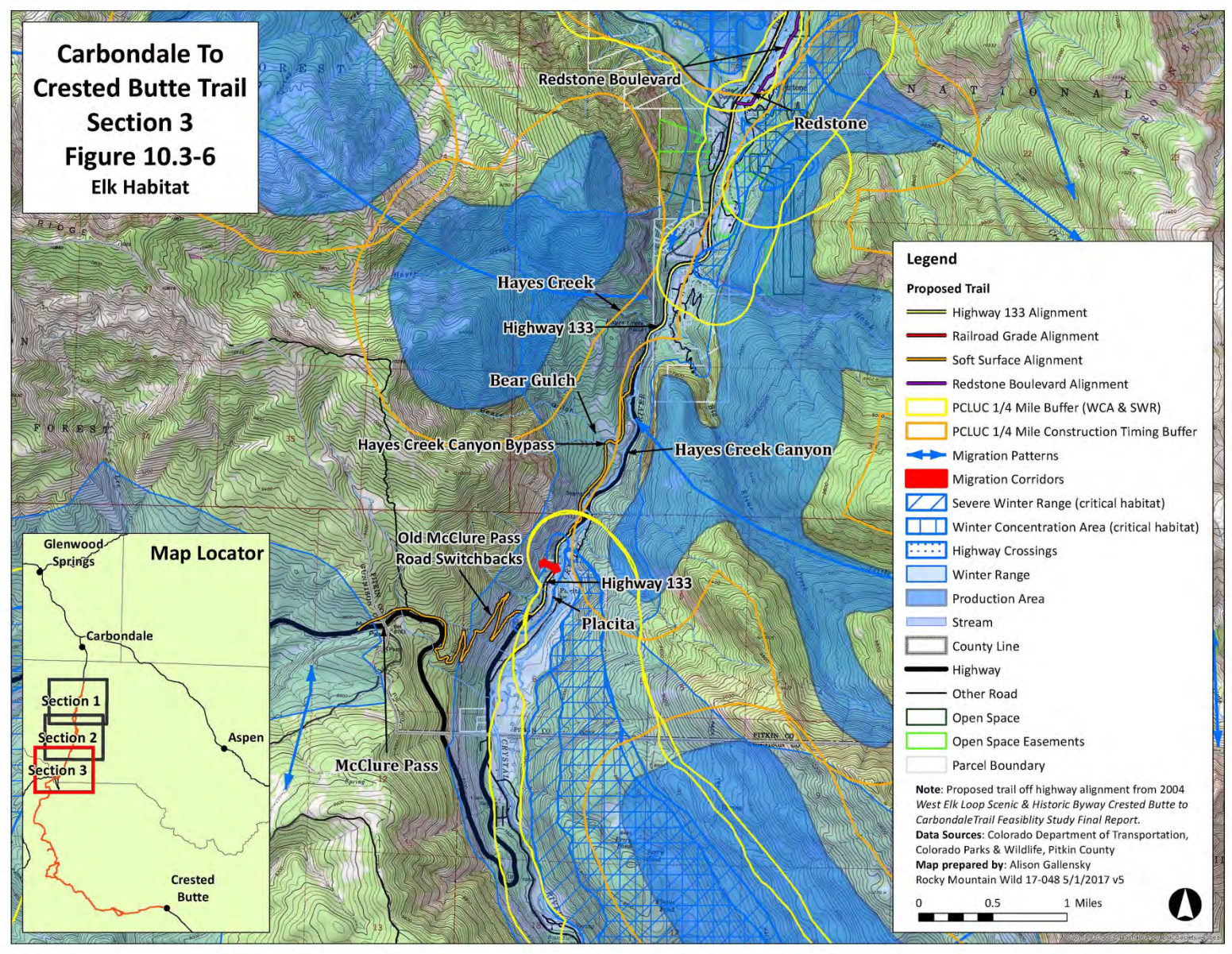

Figure 10.3-6. Elk, Crystal Valley Trail Section 3, Redstone to McClure Pass

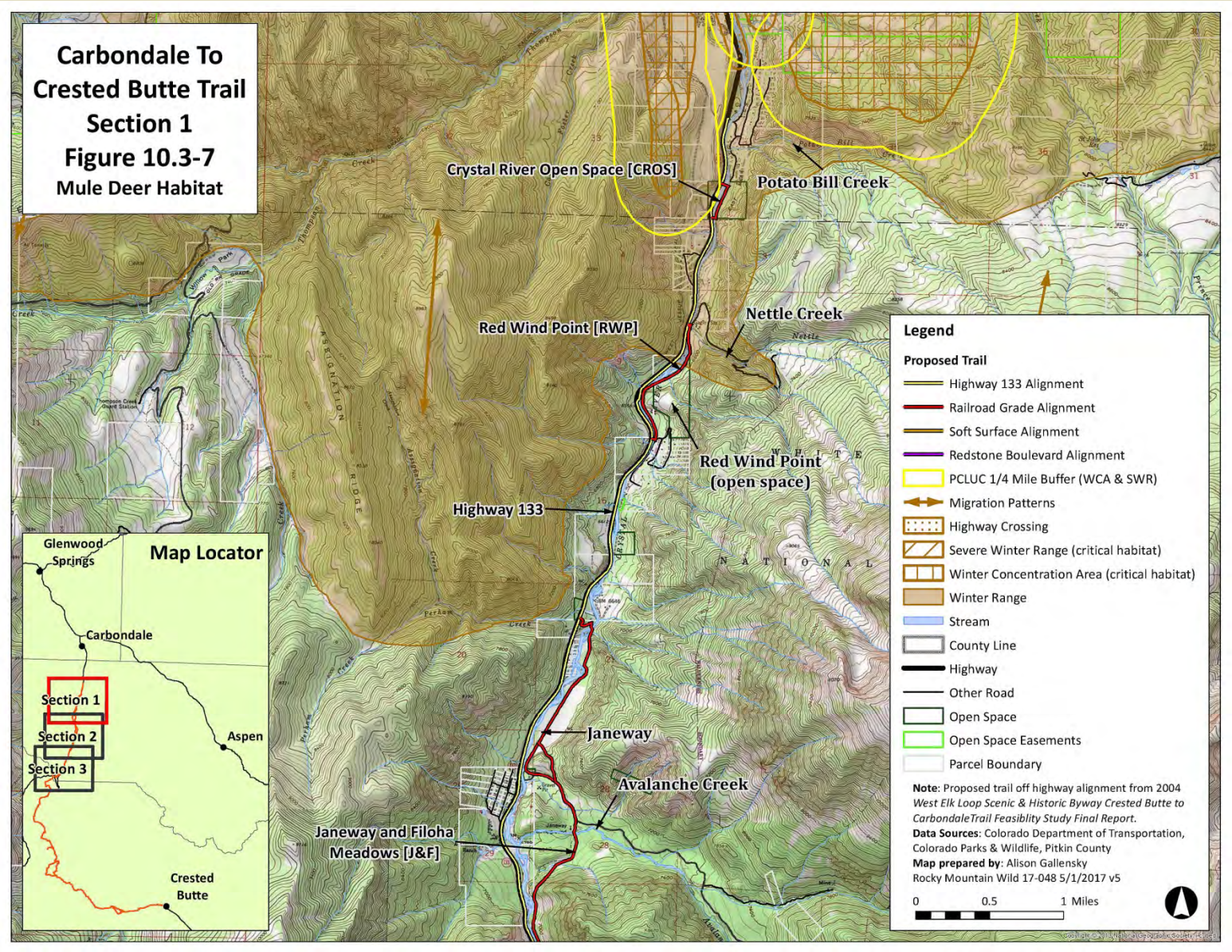

Figure 10.3-7. Mule Deer, Crystal Valley Trail Section 1, Potato Bill Creek to Avalanche Creek

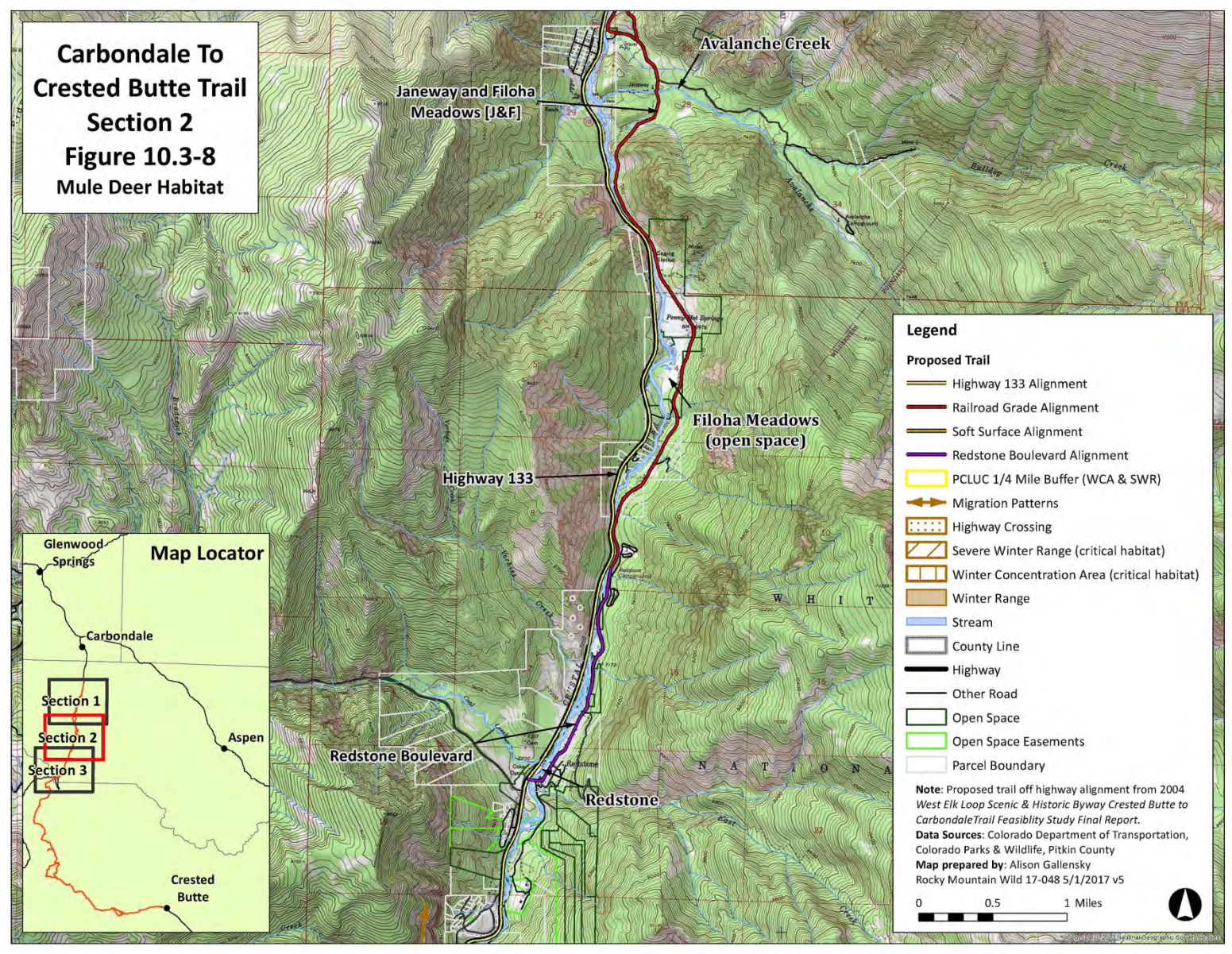

Figure 10.3-8. Mule Deer, Crystal Valley Trail Section 2, Avalanche Creek to Redstone

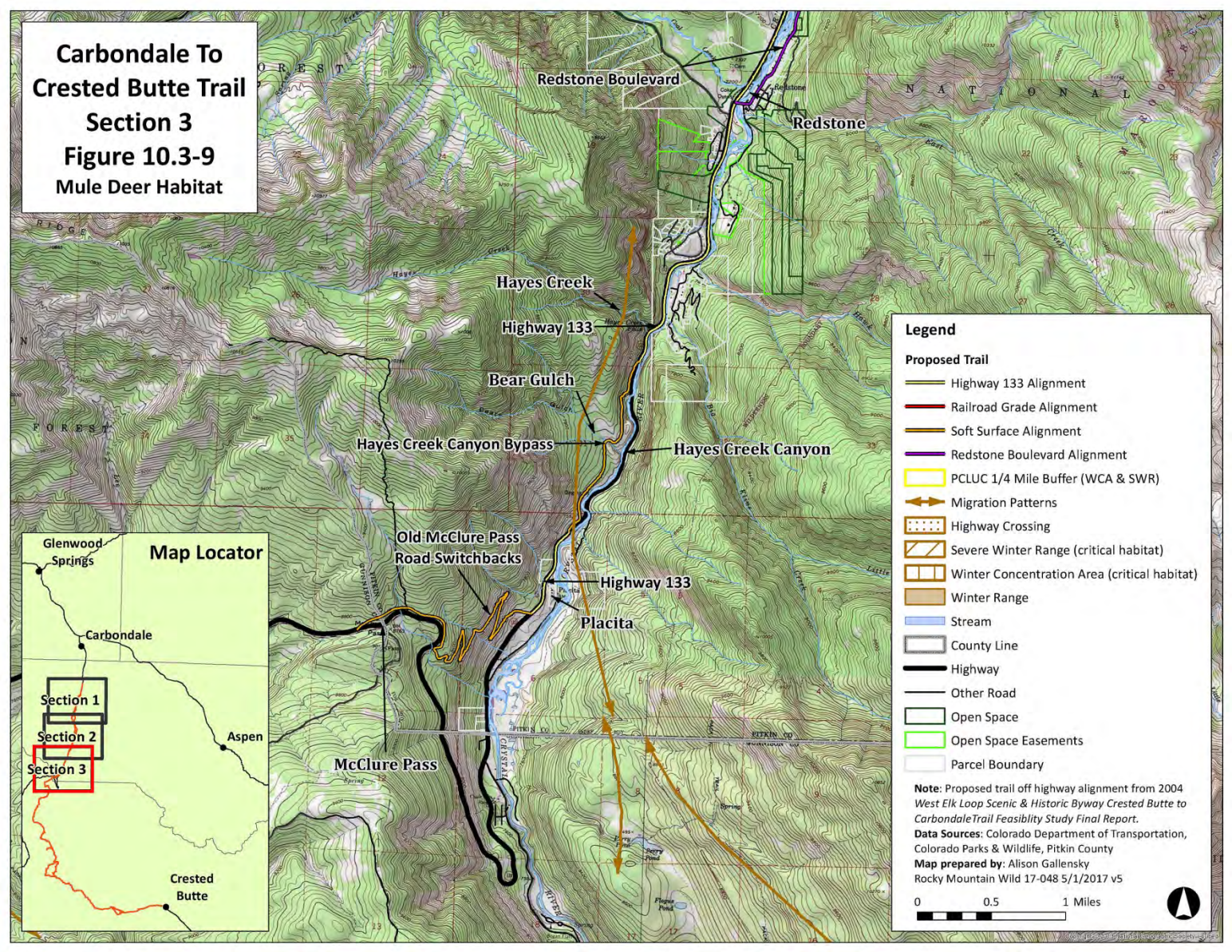

Figure 10.3-9. Mule Deer, Crystal Valley Trail Section 3, Redstone to McClure Pass

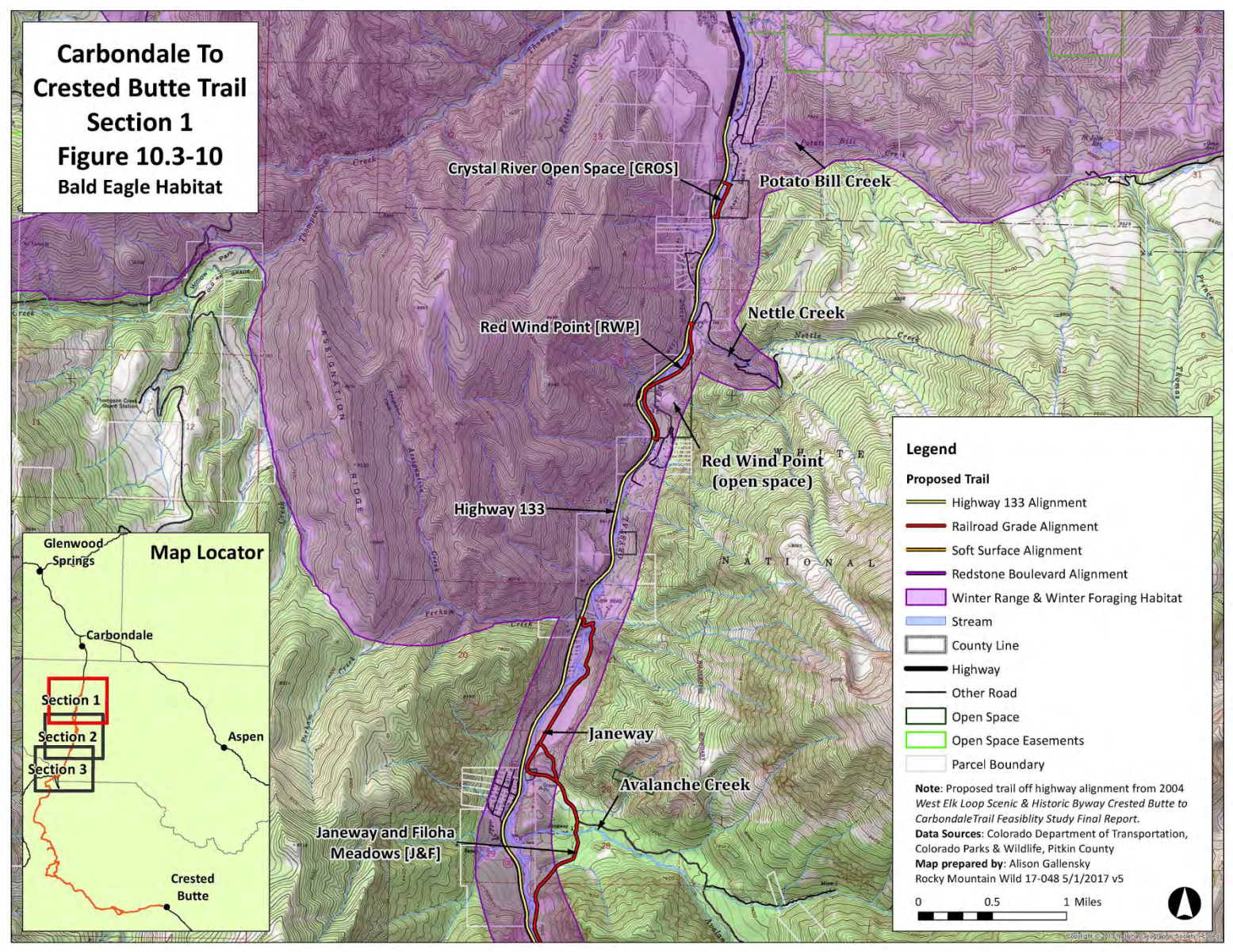

Figure 10.3-10. Bald Eagle, Crystal Valley Trail Section 1, Potato Bill Creek to Avalanche Creek

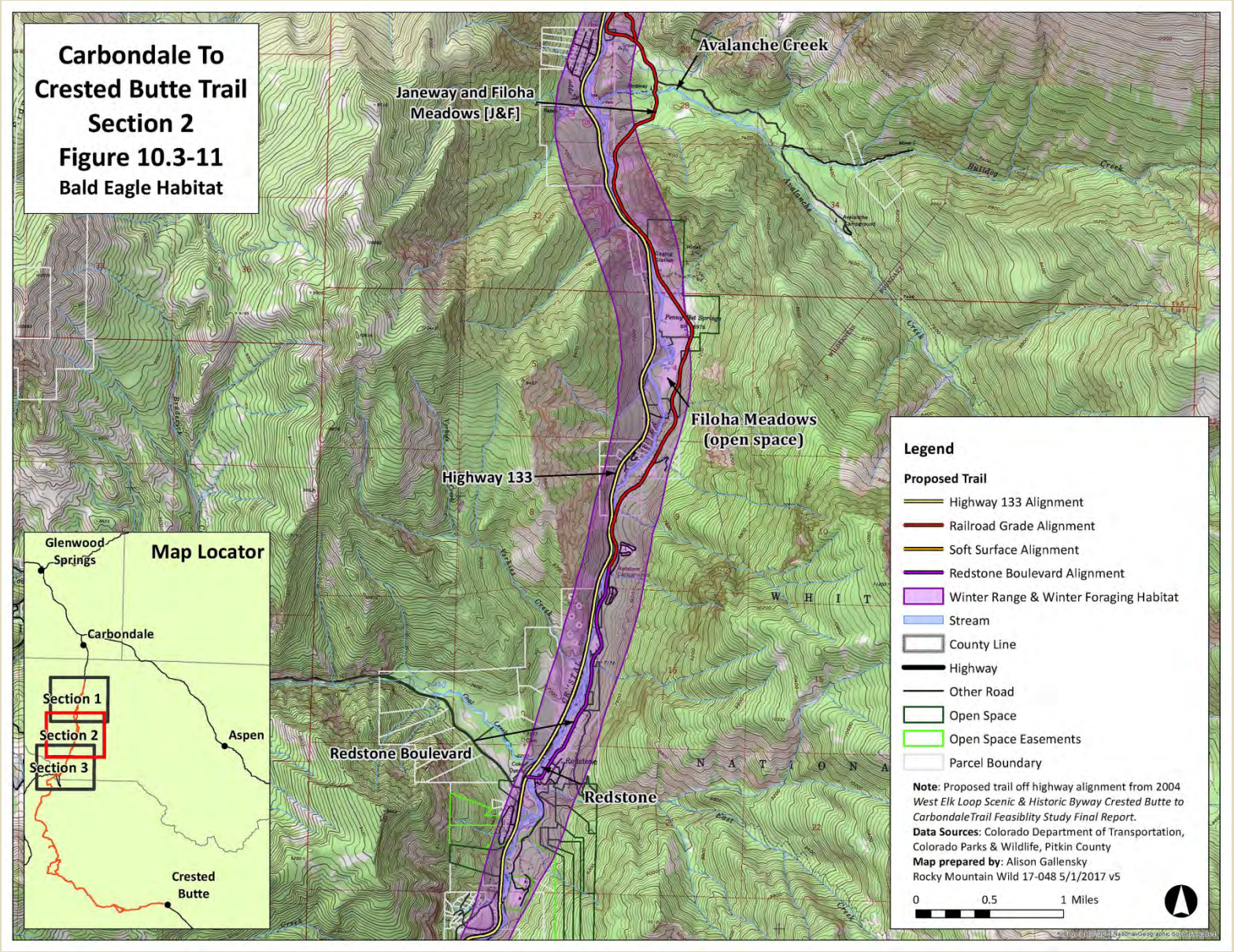

Figure 10.3-11. Bald Eagle, Crystal Valley Trail Section 2, Avalanche Creek to Redstone